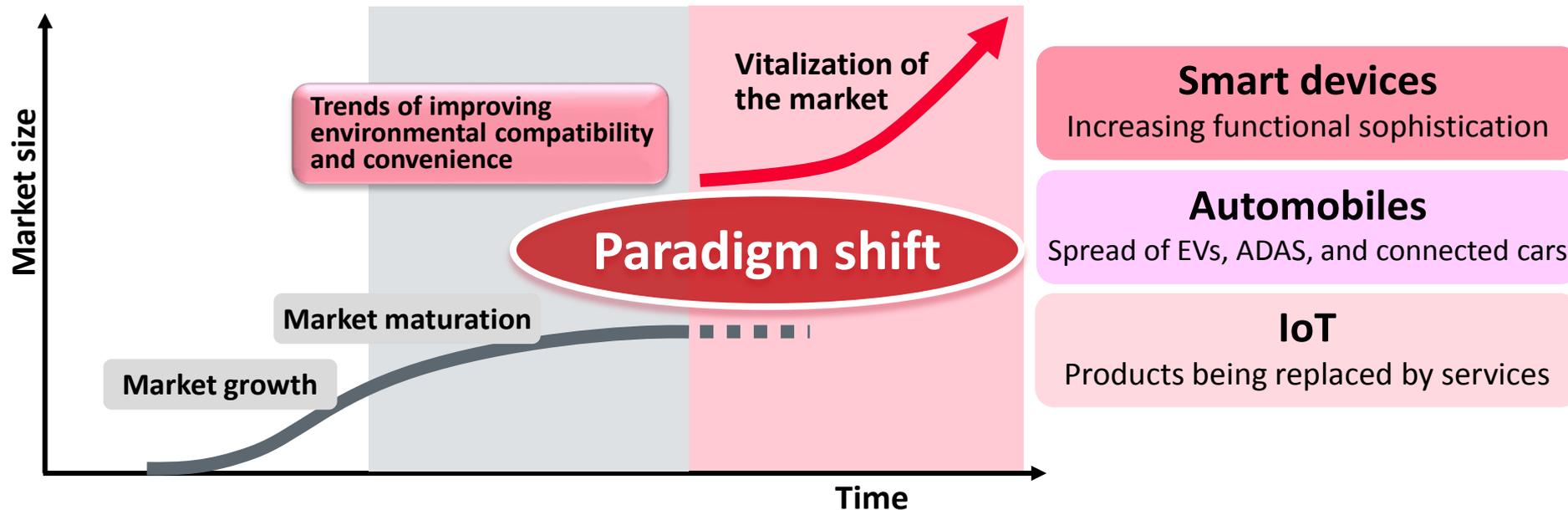


# Information Meeting 2017



# Murata and Market Environment

Electronification/digitalization of all activities in the world increases demand for electronic components



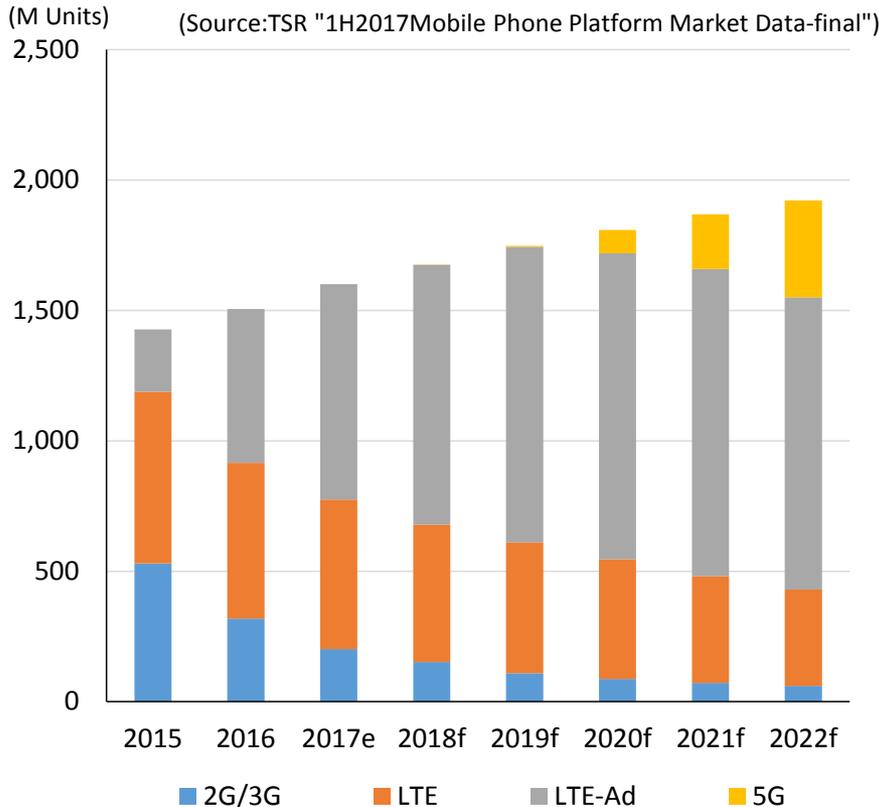
Mergers & acquisitions of energy, medical, and wireless communication businesses for further growth



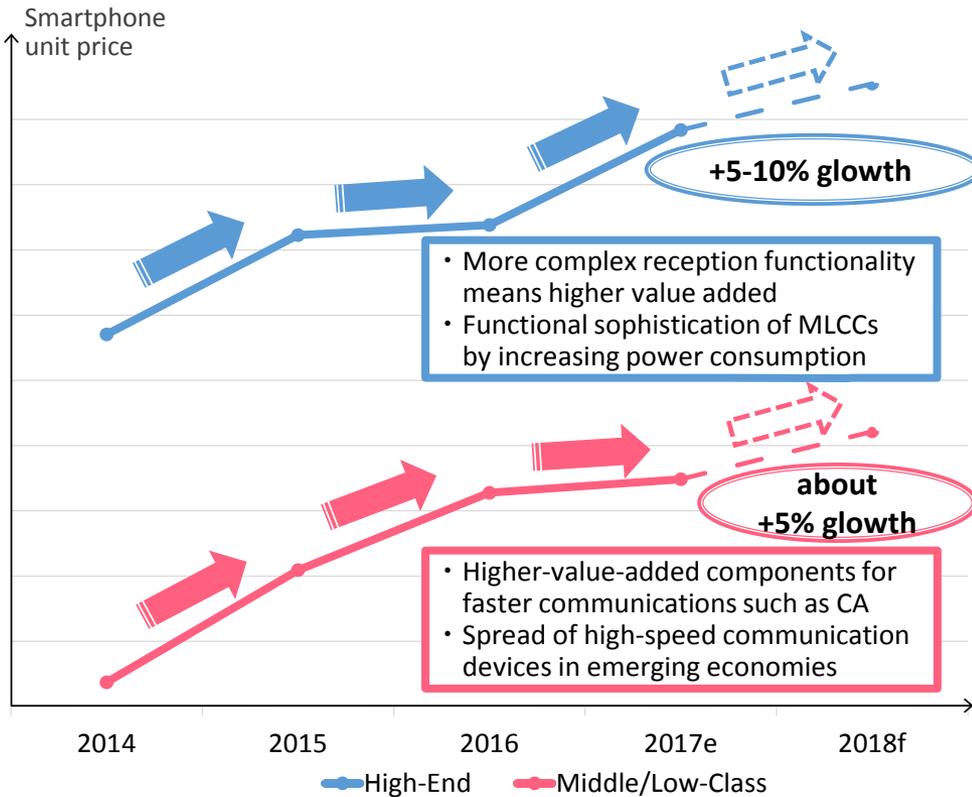
Electronic components/solutions, which underpin change and are required for change, are offered to ensure continued growth

# Growth of the smartphone market

## Outlook for smartphone unit sales growth



## Sales per smartphone



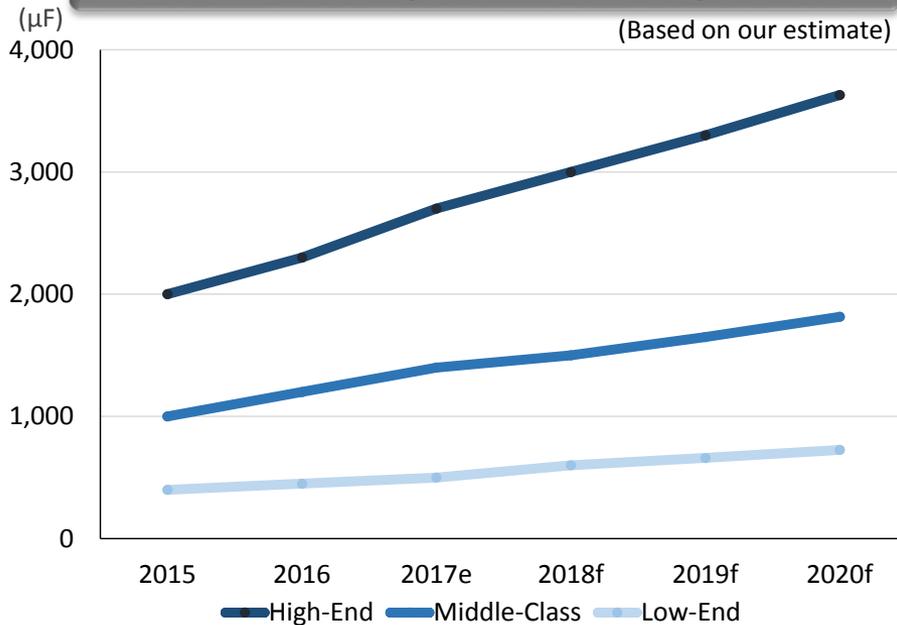
**Despite the slowdown of growth in overall unit sales, carrier aggregation phones will increase their share**

**Functional sophistication of smartphones leads to a continued rise in sales per phone**

# Smartphone Trends and an Increase in MLCC Capacity

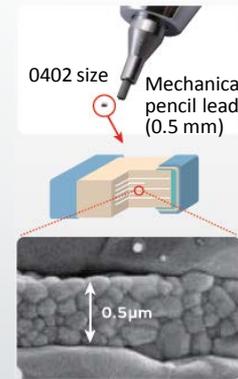
## MLCC capacitance history

(Based on our estimate)



## Strengths of Murata capacitors

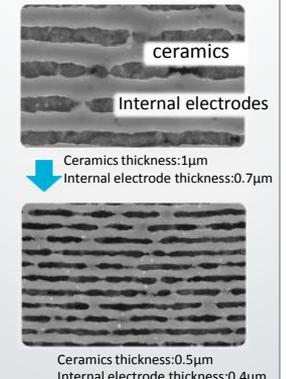
### Thinner Thin layer technology



### More compact Fine particle technology



### More accurate High-accuracy multilayer technology



## Trends in smartphones

- ✓ Higher IC and camera performance
- ✓ More sensors used per phone
- ✓ New functions available (Wireless power transfer, AR functions)
- ✓ Larger batteries

## Needs for MLCCs

- ✓ Simultaneous downsizing and capacity increases
- ✓ Characteristics tailored to applications ... high temperatures, high voltages

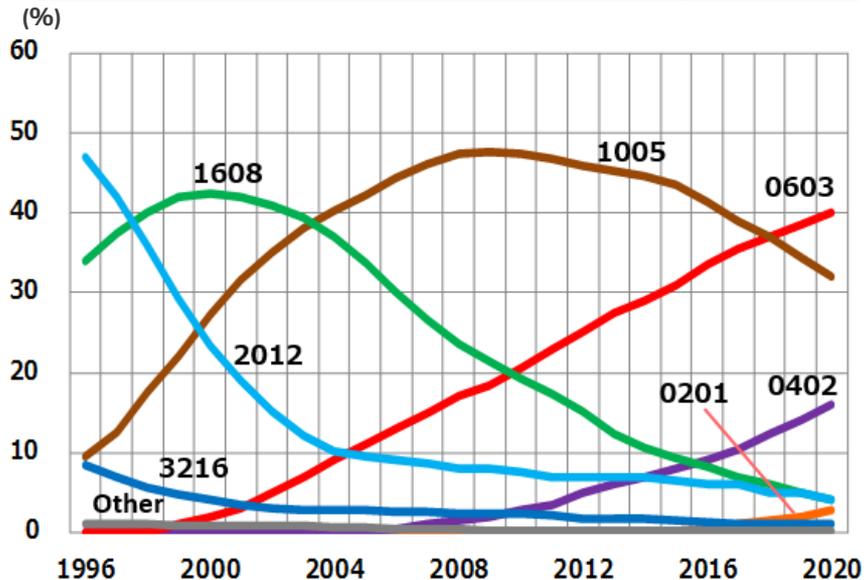
Functional sophistication of smartphones continues to generate needs for higher power consumption and smaller size



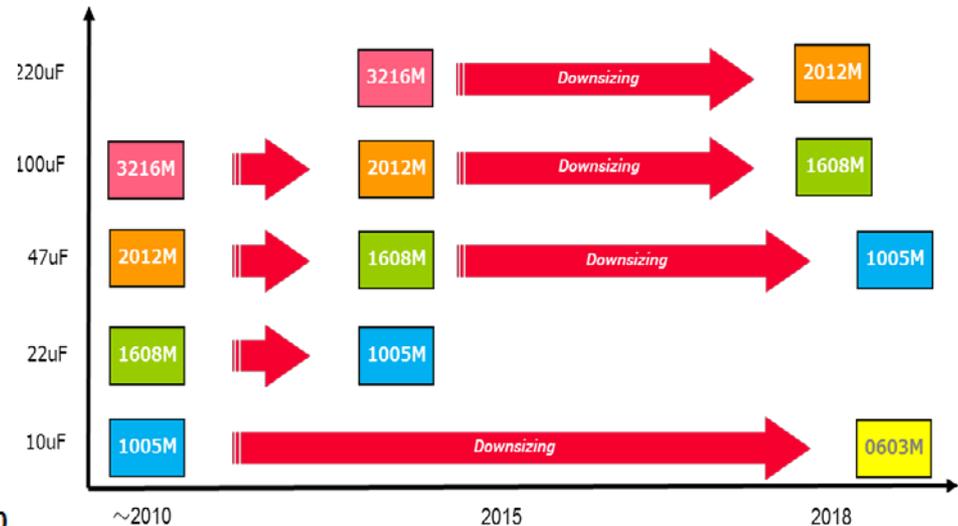
**Expansion of areas where Murata is the strongest!**

# New MLCC Products

## MLCC Size Trend



## Trend toward High-Capacitance MLCCs

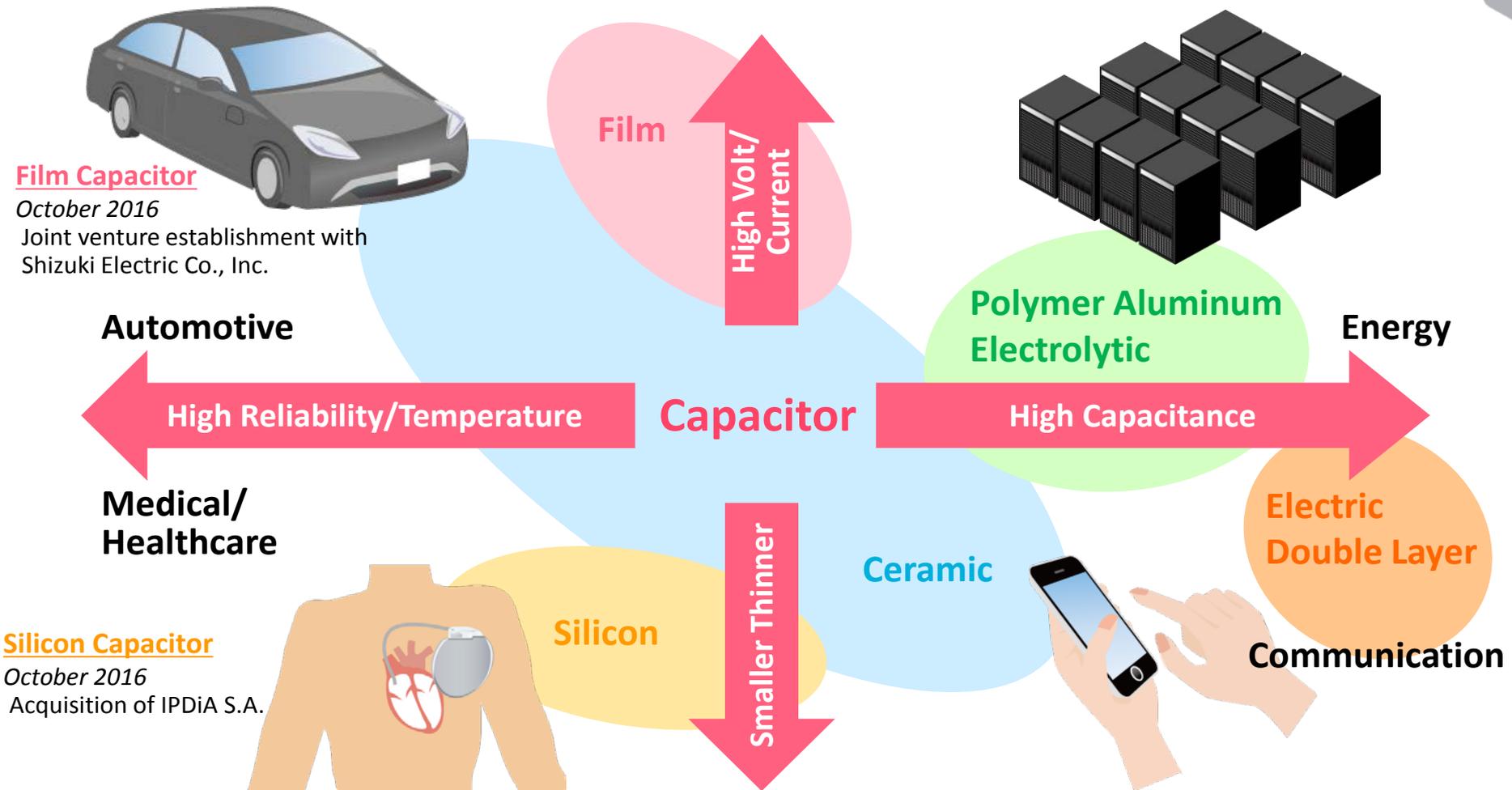


- Ultra-compact MLCC market (in which Murata has large share) will expand. 0603 size will be used as mainstream from 2018
- The usage of 0402 (0.4×0.2mm) size will expand
- We started mass production of the world's smallest 0201 size (0.25×0.125mm)

- MLCC's density of electrostatic capacity increases year by year
- Trend of MLCC's miniaturization and hi-capacitance will continue
- Increase added value by shifting high-technology product in product mix

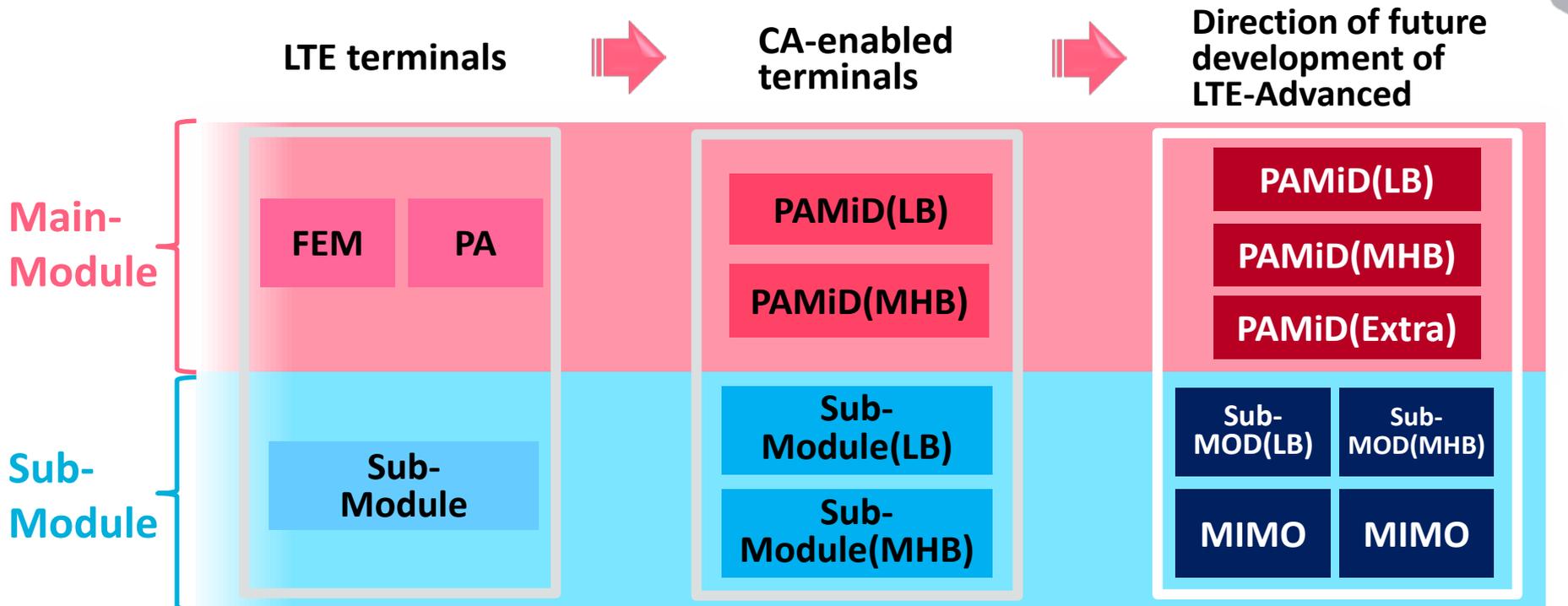
**We are pursuing trend toward miniaturization and high-capacitance MLCCs as the top runner of the market, and continue to lead the electronics industry**

# Murata as a Capacitor House



As the leading capacitor manufacturer, Murata aims for continued growth. To this end, it will not only refine its own technology further, but also take merger, acquisition, and alliance approaches to expand its business domain.

# RF Module Solution



- **High-speed communication...**  
increasing the number of frequencies covered, accommodating higher frequencies
- **More stable communication...**  
Introducing sub-modules

- **Introduction of CA...**  
makes main modules more complex

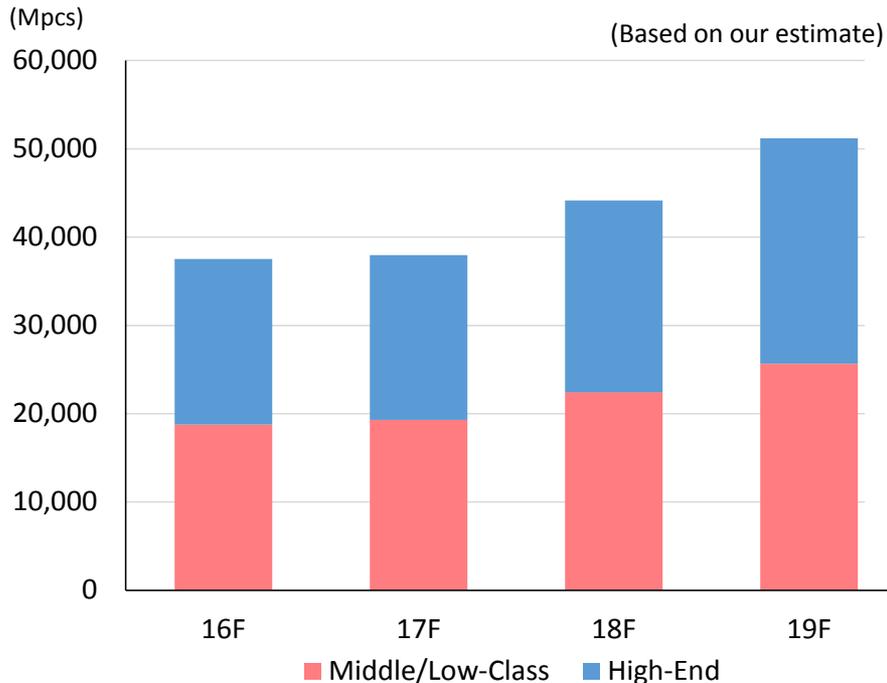
- **Introduction of MIMO technology...**  
increasing the complexity and functionality of sub-modules

The complexity and functionality of sub-modules will increase in the future

--> **Performance and supply power for filters, key components in sub-modules, will count**

# Strategies for SAW Filters

## Projected demand for SAW filters



## Prospects for Murata SAW filters



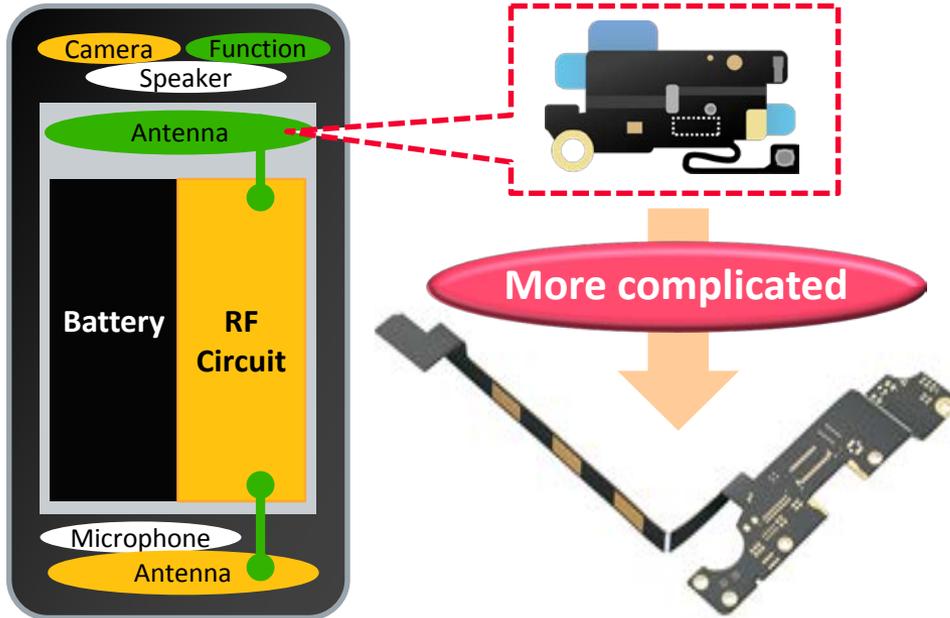
Average number of SAW filters used per phone

- ✓ High-end  
Sophistication of reception functions will increase the average number per phone
- ✓ Medium/low class  
Increasing sales of LTE phones for emerging economies will result in higher demand for SAW filters and a greater number of filters per phone

- ✓ With its performance and supply power, Murata will increase sales by accommodating increasing demand due to the development of LTE in emerging economies!
- ✓ In the area of I.H.P. SAW filters, we will help improve RF module performance by further developing high-value-added filters such as multiplexers!

# Future Development of MetroCirc™

## More complexity of MetroCirc™



Functional sophistication of smartphones will rapidly increase the scope of MetroCirc™ use

**【More complexity】**

- Increase in size
- Increase the number of folds
- Rise in the number of mounted

**--> Strengthening our response to rapid changes in technical specifications!**

## Future development of MetroCirc™

**-2021**

**Aiming for net sales of ¥100 billion!**

**2018-**

Expanding the scope of non-smartphone applications such as wearable products and data centers!

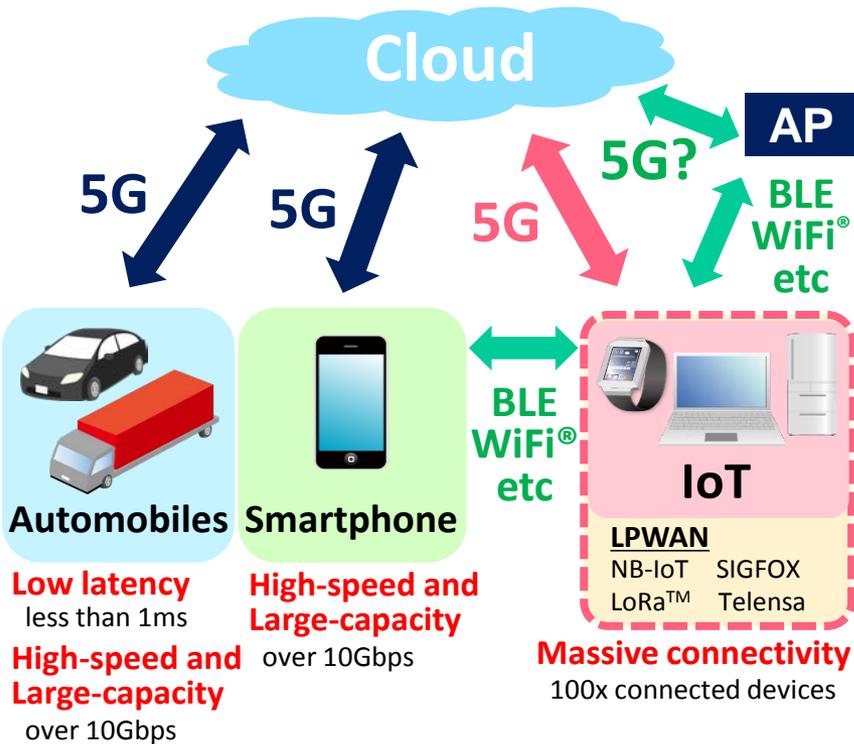
**2017-**

Increasing the additional value of high-end smartphones

- ✓ The technology will be developed further to meet the technical standards required by customers
- ✓ Leveraging excellent transmission efficiency and flexibility, as well as low profile, we will find new applications outside smartphones

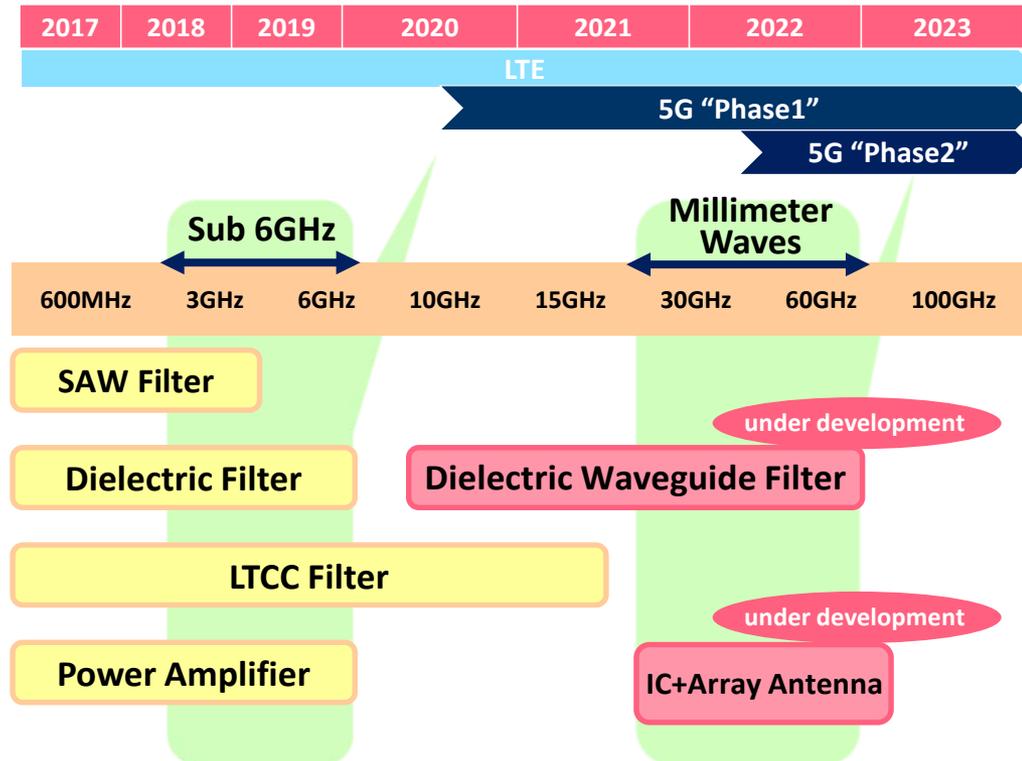
# Work on 5G Technology

## 5G uses



Use of IoT for multi-connection technology (connecting many devices simultaneously), low delay concepts e.g. for autonomous driving that implement manual commands directly at the communication partner, and content based on technologies such as 4K and VR that require high data communication capacity

## 5G roadmap



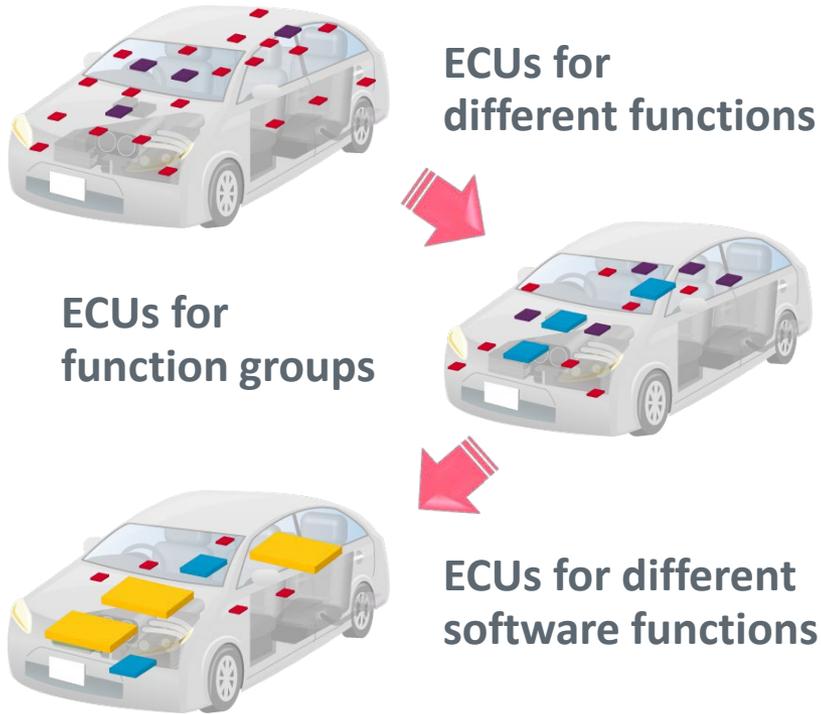
- ✓ Front end modules for new frequency bands
- ✓ Increasing number of passive components such as MLCCs due to an increase in the use of ICs
- ✓ Demand for components used for protection against heat

- ✓ Demand for antenna modules for millimeter waves
- ✓ Murata is developing technologies and antenna modules required for 5G

# Trends in Automotive Applications, and Semiconductors

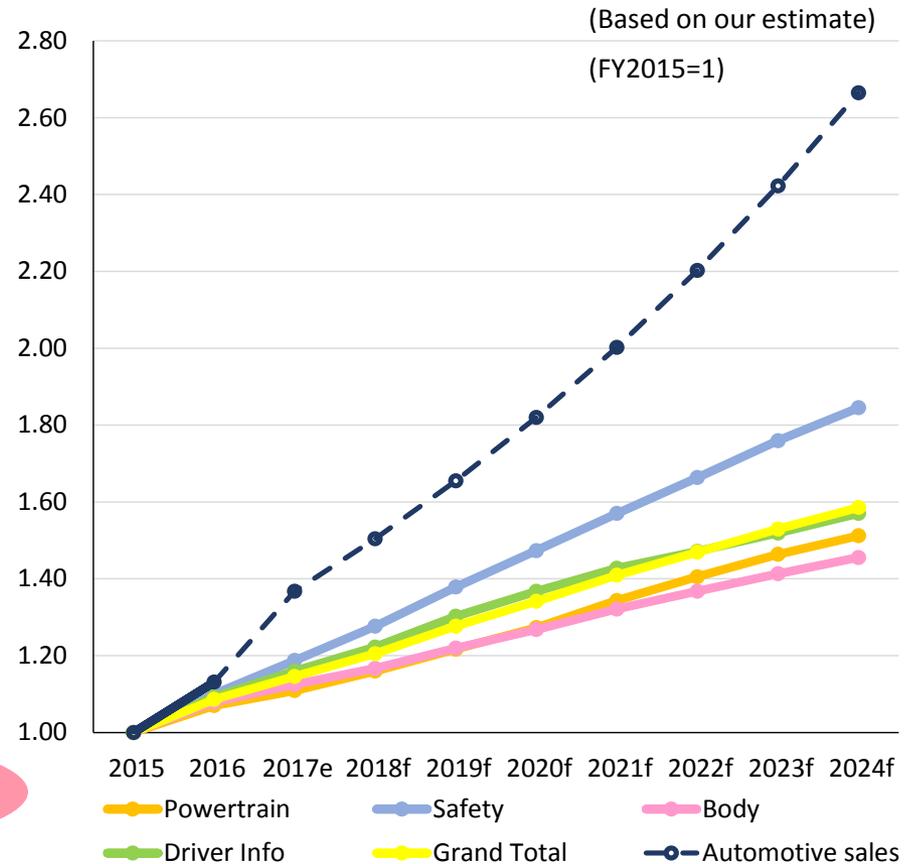


## Progress in the integration of ECUs



Progress in the integration of ECUs accelerates modularization and downsizing of components

## Outlook for sales of in-vehicle semiconductors and other in-vehicle components



**The increasing demand for electronic components due to the increase in the use of semiconductors will likely expand sales. We aim to increase annual sales by 10%!**

# Direction of Future Development of In-vehicle MLCCs

## Quantities of MLCC used

(pcs)

	Conventional	Low-end	Mid-class	High-end	Ultra High-end
	Pure ICE	ISS	Micro HEV	Mild, Strong HEV, PHEV	EV, ECV
PowerTrain	450~600	600~800	800~1,000	1,900~2,300	2,700~3,100
Safety	1,000~1,400				
Comfort	500~800				
Infortainment	400~700				
Others	500				

(Based on our estimate) \*as of FY2017



**The progress in electrification will result in a rapid increase in the number of MLCCs per vehicle from 1,000-3,000 pieces at present to 3,000-6,000 per vehicle!**

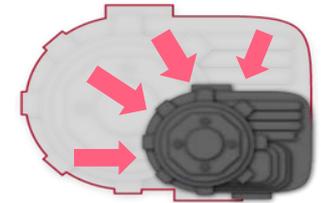
## Requirements for in-vehicle MLCCs

Need to use smaller ECUs to provide more in-vehicle space

--> **Needs for smaller MLCCs**

ECUs installed closer to the powertrain

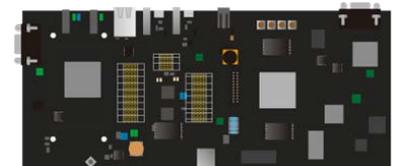
--> **Needs for MLCCs for high voltages**



## Image processing to allow for autonomous driving

Fast processing of data from various sensors results in higher power consumption

--> **Greater MLCC capacity and a larger number of MLCCs used per vehicle**

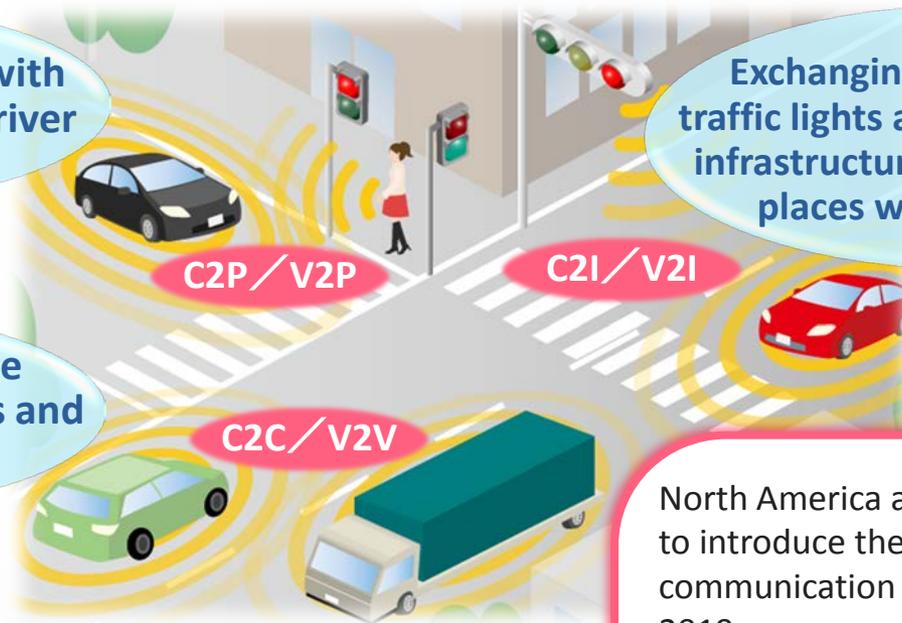


# Connected Car (C2X/V2X)

Exchanging information with pedestrians to alert the driver

Exchanging information with traffic lights and other elements of infrastructure to ensure safety at places with poor visibility

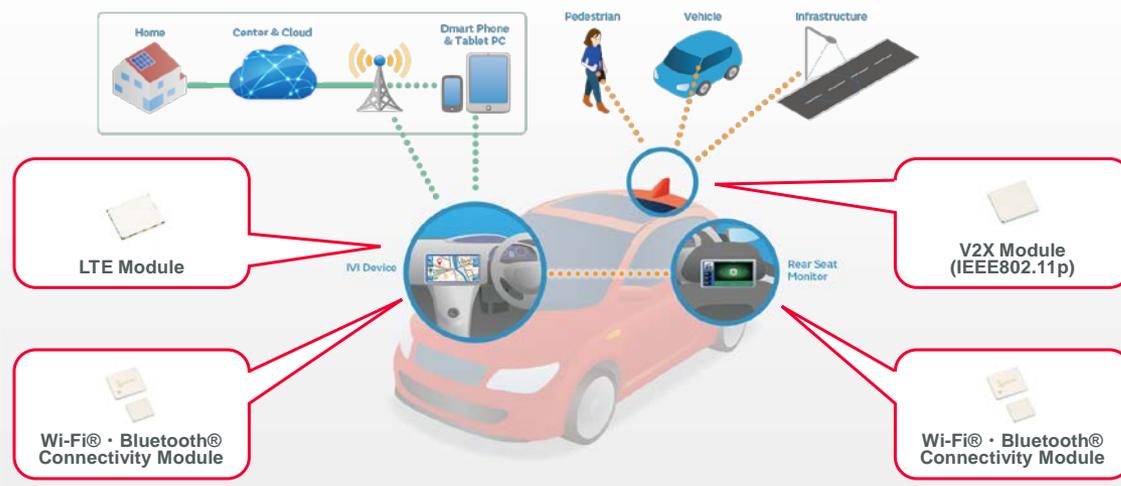
Vehicles mutually exchange information on their locations and speeds to avoid collision



North America and Europe have plans to introduce the IEEE 802.11p V2X communication method starting in 2019.

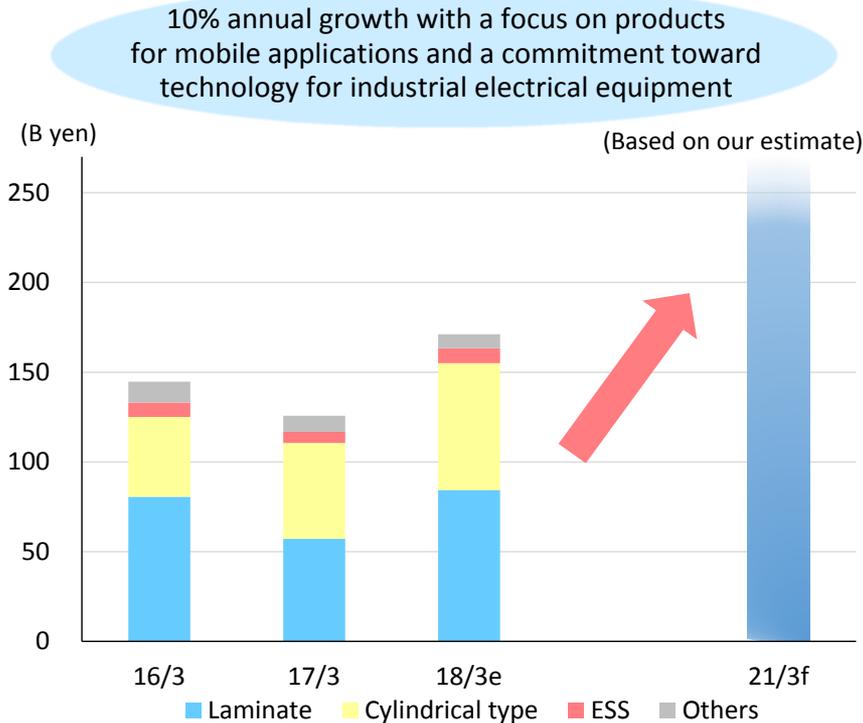
--> V2X wireless communication modules and software are now being developed at Murata.

- Stable characteristics at high temperatures
- Competitive software support services allow us to get involved in the early phase of customers' design/development process.

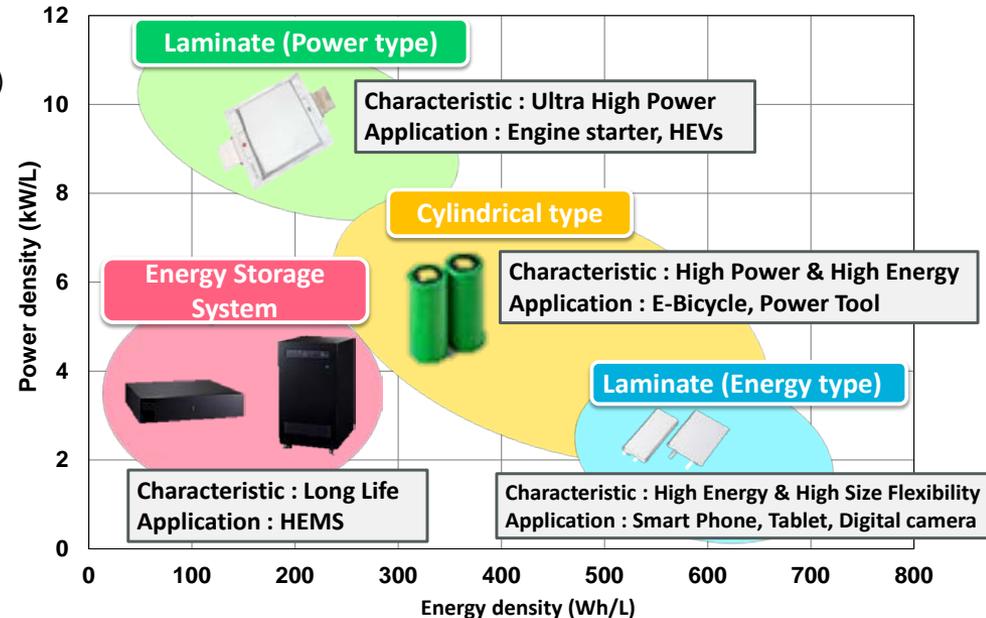


# Acquisition of a Lithium-ion Secondary Battery Business

## Projected sales of lithium-ion secondary batteries



## Types of lithium-ion secondary battery technology



## Restructuring of the business after Murata acquisition

**Laminate** : reassessing safety following incidents affecting battery quality, and improving the share of new product share in keeping with technological development

**Cylindrical** : increasing supply by expanding the scope of applications and due to market growth

**ESS** : emphasizing characteristics of olivine-structured lithium iron phosphate to promote sales in the markets for homes and power/industrial equipment

# New Energy Strategies (to generate synergy from integration in Murata)

## All-solid-state battery

Very safe



No liquid leaks

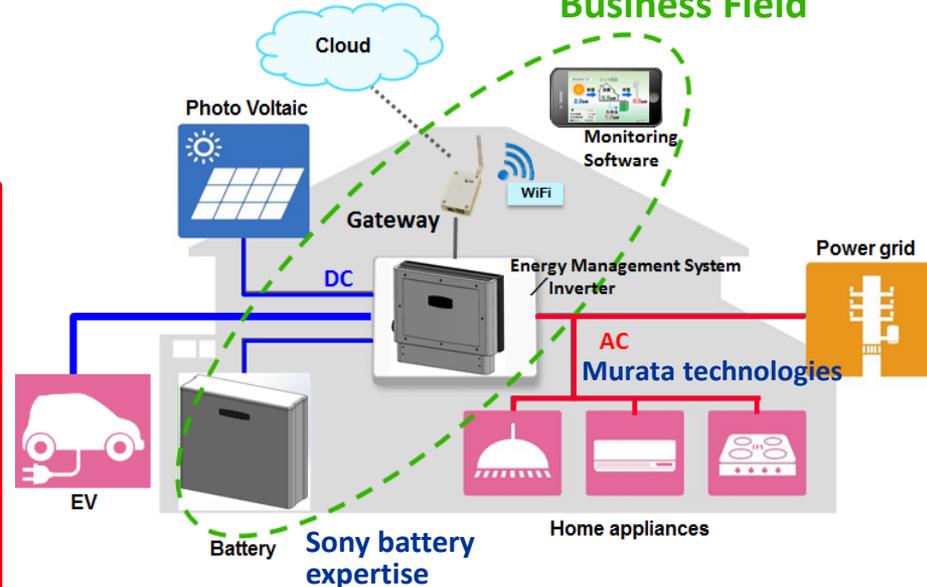


No gas expansion

	Liquid/polymer gel-based	All-solid-state battery
Structure/ appearance		
Feature	<ul style="list-style-type: none"> <li>Contains combustible liquid</li> </ul>	<ul style="list-style-type: none"> <li>Uses an incombustible solid material</li> </ul>
Pros	<ul style="list-style-type: none"> <li>Easily conducts high currents</li> </ul>	<ul style="list-style-type: none"> <li>Non-ignitable and incombustible</li> <li>Simply structured</li> <li>--&gt; Contains not too many components</li> </ul>
Cons	<ul style="list-style-type: none"> <li>Has the risk of ignition and combustion</li> <li>Gas expansion at high temperatures</li> <li>Requires laminate sealing</li> </ul>	<ul style="list-style-type: none"> <li>Difficult to upsize</li> <li>Makes it difficult to generate high currents</li> </ul>

## EMS combining inverter technology and high-performance battery

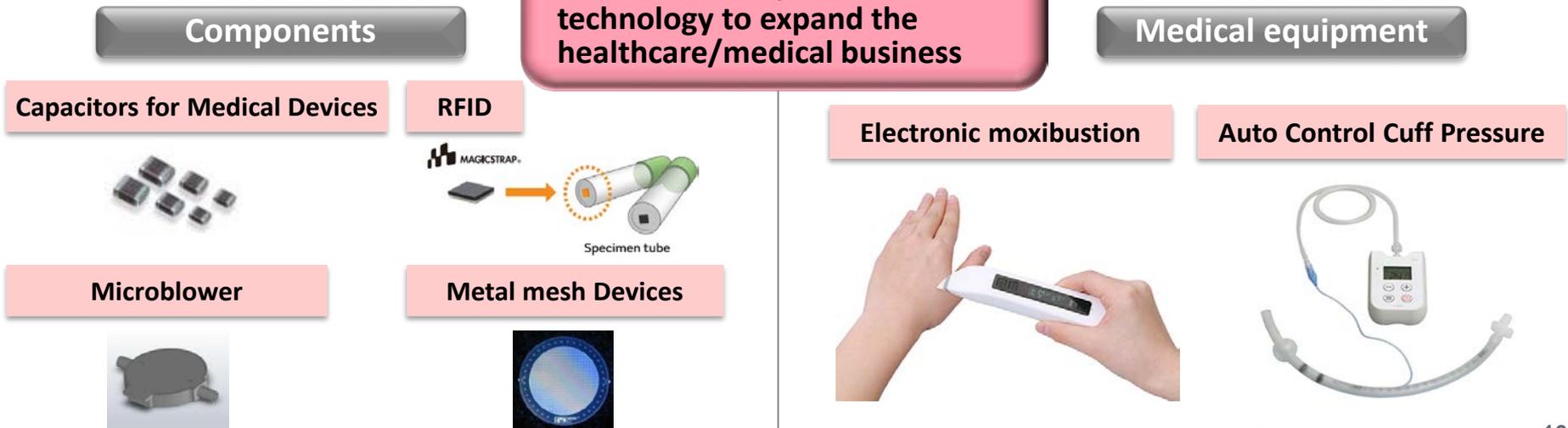
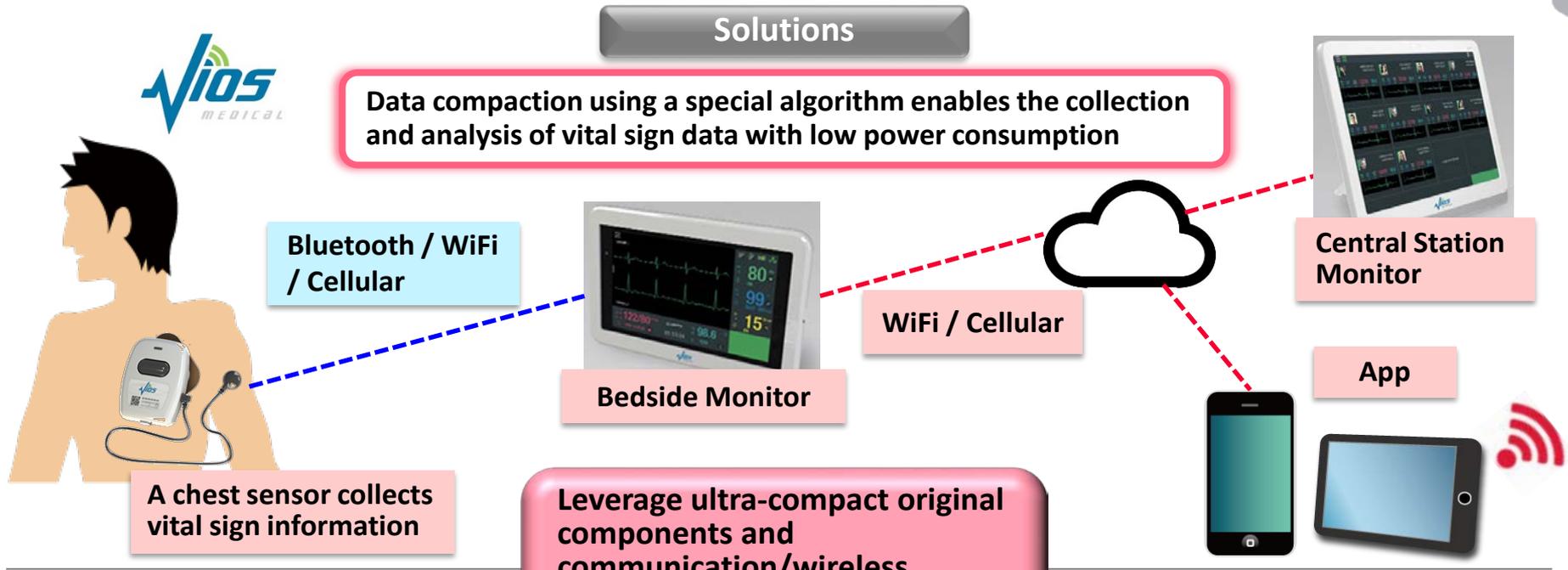
Murata's  
Business Field



## "Create," "store," and "wisely use" energy

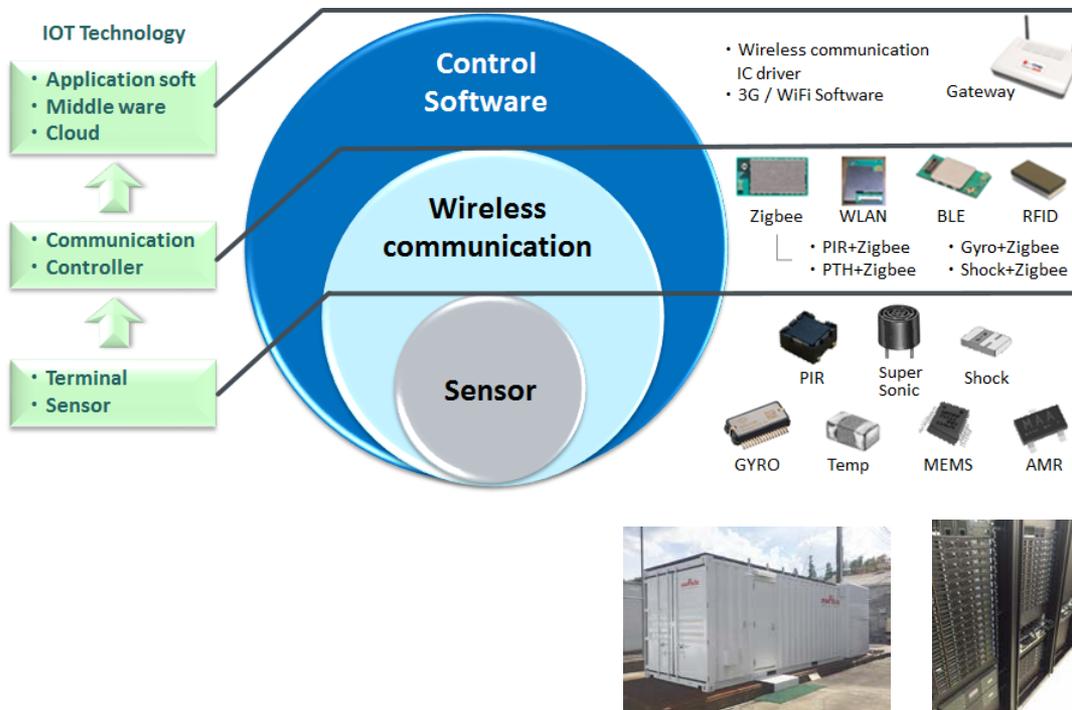
- Leveraging the combination of Murata inverter technology with Sony battery expertise for differentiation in terms of safety, output, and efficiency
- Providing support in building eco-systems featuring local production and consumption of energy and distributed power supply network systems

- High affinity to MLCCs in terms of structure and production process
- Combining Sony's material and design technologies with Murata's process technology will help review the structure and production process for early commercialization
- The first target is a compact wearable device, to be commercialized by 2019





# Spread of IoT Business



## Business opportunities for Murata

**Development of communication networks**

- LPWA
- BLE
- Base stations

**Securing energy**

- HVDC for data centers
- Backup power supplies

**Offering solutions**

- Sensors
- Gateways
- Collaboration with third parties

**Intelligent home appliances**

- AI speakers
- Passive components

**Wireless communication:** Ensuring a connection with a target without crosstalk in a network comprised of multiple devices

**Sensors:** Murata is a comprehensive component manufacturer with strong components

**Software:** Software technology developed in the markets for mobile phones and Wi-Fi

**Murata will provide total solutions combining sensors, wireless technology and software to help build infrastructure for the "Internet of Things"**

# Various Initiatives on IoT Technology

## Example 1 : Virtual sensor project

Enabling the creation of services that the visualization of the atmosphere of the place and the familiarity of the human being

### Collection

Collect data from sensors

### Connection

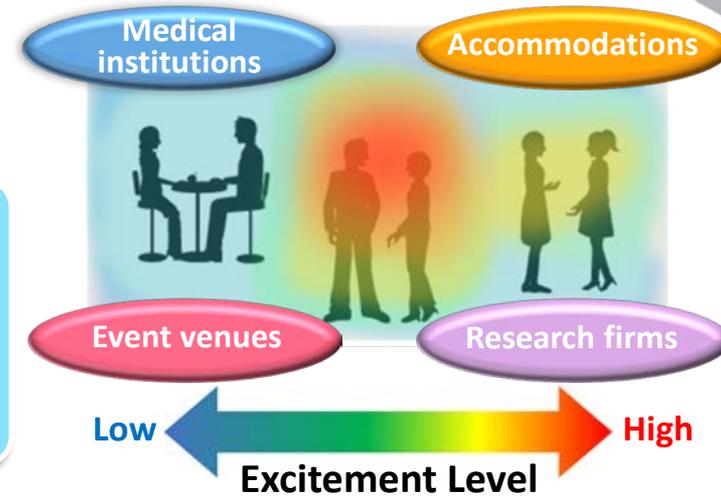
Upload the sensor data to the cloud

### Control/organization

Use the sensor data to interpret space information such as atmosphere and productivity

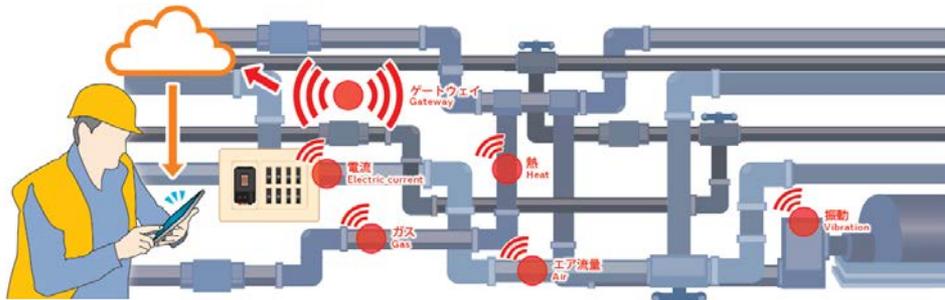
### Third-party data integration

Visualize levels and changes in atmosphere and productivity by location



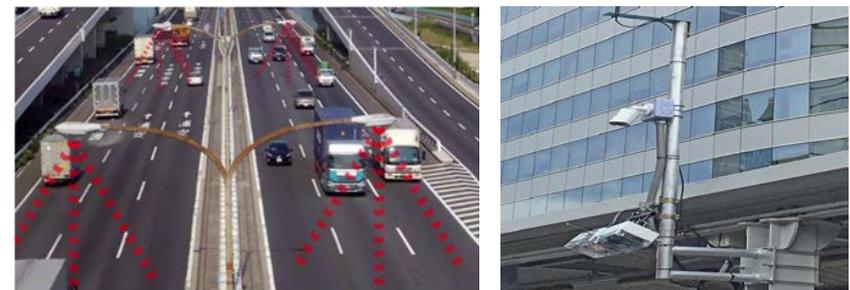
## Example 2 : Real-time Monitoring System for Factory

Launch of mass-production of sensor nodes that enable simple preventive diagnosis of rotating equipment



## Example 3 : Road traffic volume monitoring

Collection of information incl. traffic volume, vehicle speeds, and environmental parameters by road lane



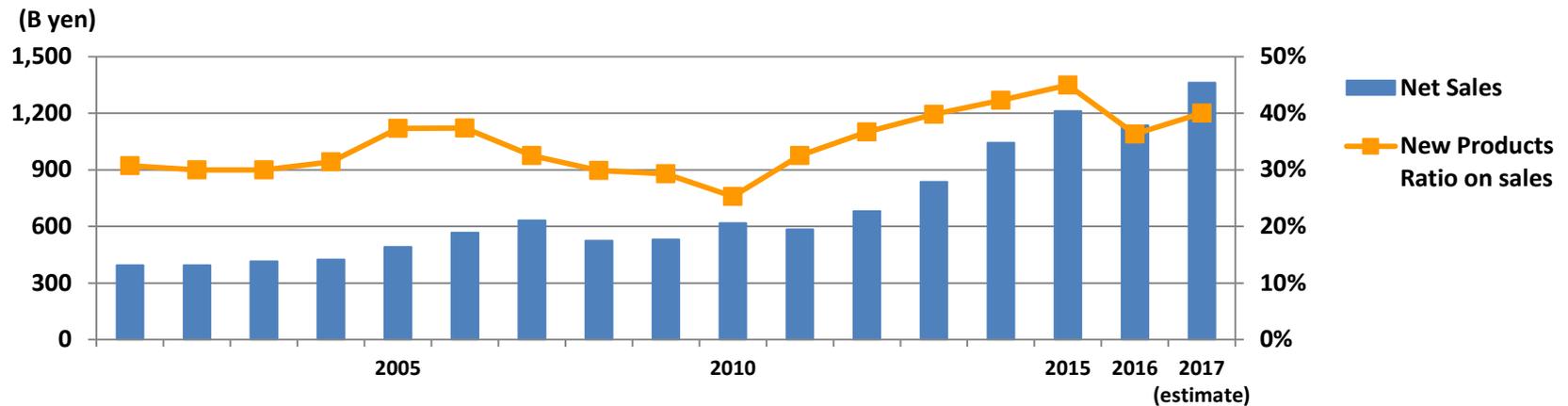
\* Sensor nodes

**The information is provided to users to gain compensation for its value**

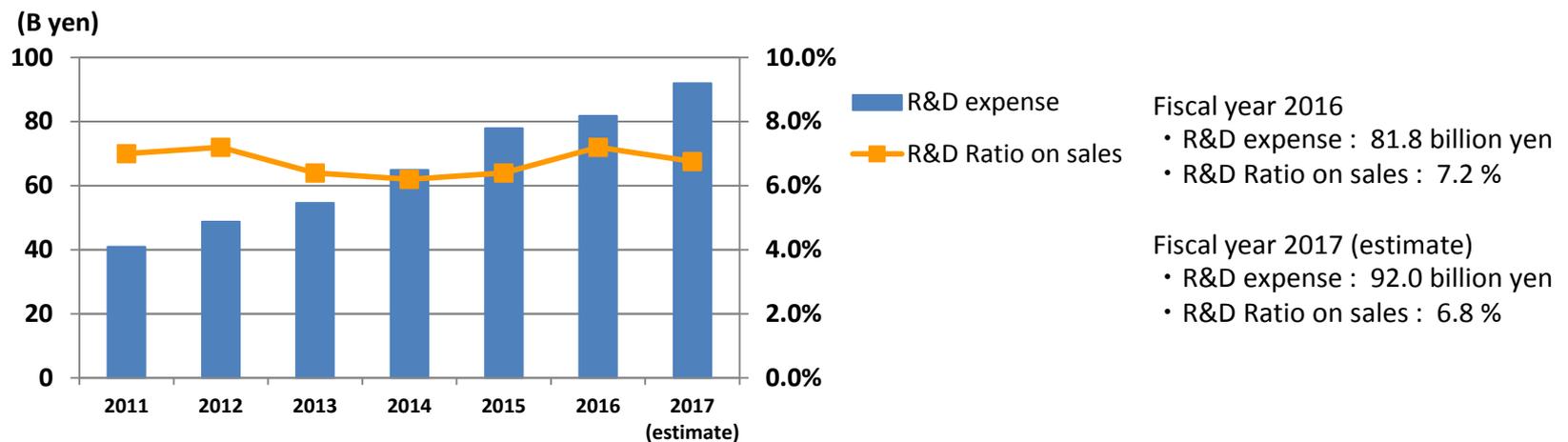
# Net Sales and New Products Ratio on sales/ R&D expense and R&D ratio on sales



## Net Sales and New Products Ratio on sales



## R&D expense and R&D Ratio on sales



# M&A / Business Alliance

 <ul style="list-style-type: none"> <li>• Joint venture establishment with Shizuki Electric Co., Inc.</li> <li>• <b>Film Capacitor</b></li> </ul>  <ul style="list-style-type: none"> <li>• Acquisition of IPDiA S.A.</li> <li>• <b>Silicon Capacitors</b></li> </ul>	 <ul style="list-style-type: none"> <li>• Acquisition of Arctic Sand Technologies, Inc.</li> <li>• <b>Design and sale of Low-power semiconductors</b></li> </ul>	 <ul style="list-style-type: none"> <li>• Acquisition of ID-Solutions S.r.l.</li> <li>• <b>RFID system integration</b></li> </ul>	 <ul style="list-style-type: none"> <li>• Acquisition of Battery Business from Sony Corporation</li> <li>• <b>Lithium-ion Secondary Batteries</b></li> </ul>	 <ul style="list-style-type: none"> <li>• Acquisition of Vios Medical, Inc.</li> <li>• <b>Development of chest sensors, and development and provision of software and cloud services needed to monitor the sensors</b></li> </ul>
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- Toko, Inc. became a consolidated subsidiary of Murata
- **Coils**



- Acquisition of Peregrine Semiconductor
- **RF solutions incl. RF switches**

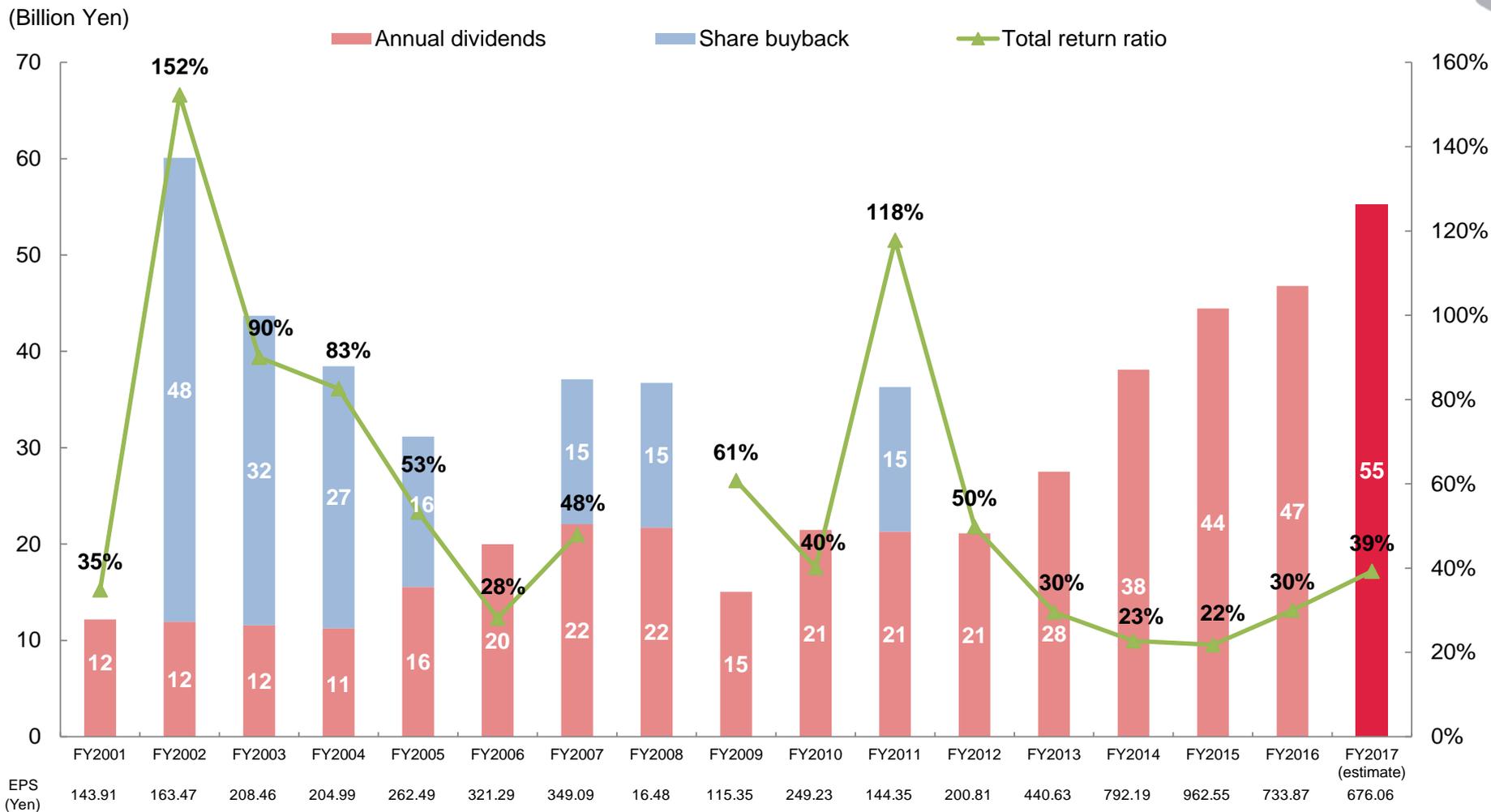


- Acquisition of Primatec Inc.
- **LCP (liquid crystal polymer) electronic materials**



**Mergers & acquisitions of energy, medical, and wireless communication businesses for further growth**

# Return to Shareholders



Our basic policy of profit distribution to shareholders is to prioritize the sharing of gains through payment of dividends, and to steadily raise them by increasing profit per share.

This report contains forward-looking statements concerning Murata Manufacturing Co., Ltd. and its group companies' projections, plans, policies, strategies, schedules, and decisions. These forward-looking statements are not historical facts; rather, they represent the assumptions of the Murata Group (the “Group”) based on information currently available and certain assumptions we deem as reasonable. Actual results may differ materially from expectations due to various risks and uncertainties. Readers are therefore requested not to rely on these forward-looking statements as the sole basis for evaluating the Group. The Company has no obligation to revise any of the forward-looking statements as a result of new information, future events or otherwise.

Risks and uncertainties that may affect actual results include, but are not limited to, the following: (1) economic conditions of the Company's business environment, and trends, supply-demand balance, and price fluctuations in the markets for electronic devices and components; (2) price fluctuations and insufficient supply of raw materials; (3) exchange rate fluctuations; (4) the Group's ability to provide a stable supply of new products that are compatible with the rapid technical innovation of the electronic components market and to continue to design and develop products and services that satisfy customers; (5) changes in the market value of the Group's financial assets; (6) drastic legal, political, and social changes in the Group's business environment; and (7) other uncertainties and contingencies.

The Company undertakes no obligation to publicly update any forward-looking statements included in this report.

Thank you

