

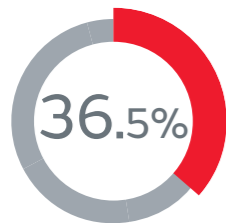
Capacitors



Multilayer ceramic capacitors

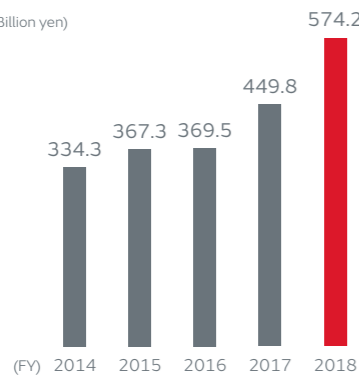
Main products

Multilayer ceramic capacitors, Polymer aluminum electrolytic capacitors, Silicon capacitors, High temperature film capacitors for automotive, etc.



Net sales  
**574.2** billion yen  
YoY  
Up **27.7%**

Net sales (Billion yen)



Operating results

In fiscal 2018, sales of multilayer ceramic capacitors for car electronics, the main product in this category, were strong as vehicle electrification progressed and demand increased in a broad range of applications, including applications in smartphones in Greater China, computers and peripherals. As a result, overall net sales were 574.2 billion yen (up 27.7% year-on-year).

Initiatives in the capacitor business

In fiscal 2018, the use of electronics increased in areas such as automobiles, and demand for capacitors rapidly increased. In response to robust customer demand, Murata has endeavored to increase production capacity, while also revising our product portfolio and increasing the amount we supply. In addition, we made requests to customers to revise the sales prices of chip multilayer ceramic capacitors (MLCCs), and allocated the proceeds to investment funds for strengthening production capacity. There is significant uncertainty regarding the direction of the global economy in fiscal 2019, which will also affect our capacitor business, but over the medium-term, we can expect new demand for applications in communications infrastructure, along with the spread of 5G, in addition to increased demand for compact large-capacity products for use in communications devices and highly reliable products for use in automobiles. We will allocate management resources to products that address this demand and develop new products, while also implementing initiatives to enhance productivity by promoting the use of smart factories.

In addition, we will enhance our range of capacitors to address the diverse needs of our customers, add non-ceramic products such as film capacitors, silicon capacitors to our portfolio, and offer new proposals with high reliability suitable for usage environments in the automotive and healthcare/medical markets.

Chip multilayer ceramic capacitors for consumer

The chip multilayer ceramic capacitor (MLCC) is an electronic component with external electrodes electrically and mechanically bonded to a substrate, attached to repeatedly stacked internal electrodes and ceramic dielectrics such as titanium oxide and barium titanate. It is a highly reliable nonpolar capacitor with high withstanding voltage and insulation resistance, superior frequency and heat-resisting characteristics, and long service life.

MLCCs are employed in mobile devices and home appliances as well as IT devices and network infrastructure equipment as they can temporarily store and discharge electricity, absorb noise in signals, extract signals with certain frequencies, and block direct current and pass alternating current only. MLCCs are also used for applications for which high reliability is required, including automotive, medical, and aerospace equipment. In particular, 600 to 1,000 MLCCs are used in one high-end smartphone. Even low-end or midrange models use 300 to 600 MLCCs per unit.

Regarding consumer MLCCs, to meet market demands particularly for those smaller in size, various products have been developed and have become highly competitive capacitors. Recently, the main product size has shifted from 1005M (1.0X0.5 mm) to 0603M (0.6X0.3 mm) and for wearable devices and small modules, consideration for adoption of 0201M (0.25X0.125 mm), the smallest size commercialized in 2014, has been increasing. Since market needs are expected to grow further for smaller components and high-density mounting, Murata will continue to improve its ceramic material pulverization and multilayer technology and propose new product design and easier to use solutions.

Chip multilayer ceramic capacitor for automotive

For automotive MLCCs, stricter regulations have been set out than those of consumer MLCCs in the areas of product material selection, design standards, product performance, and process management to achieve higher reliability and longer product life, even though materials and processes are generally the same as those in consumer MLCCs.

MLCCs have been increasingly adopted for safety applications such as airbags and ABS in addition to hybrid and electric vehicles that have become increasingly widespread, and production of these packages is rapidly increasing. Moreover, components employed by many customers are becoming smaller and the main size is shifting to 1005M (1.0X0.5 mm) from 1608M (1.6X0.8 mm). Also, these satisfy requirements of temperature cycling tests and high temperature and high humidity load tests

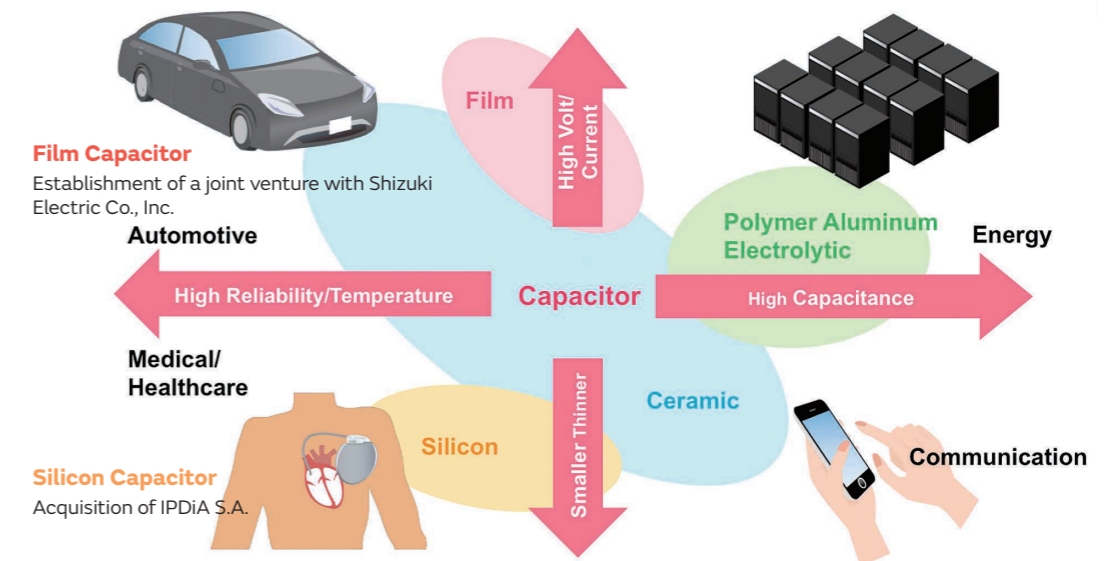
at 150°C, a step up from the previous guarantee of 125°C. Furthermore, more products meet requirements specific to in-vehicle applications regarding static electricity and surge tests (ISO7637-2). Recently, products which can be used in higher temperature environments are in demand.

To respond to tough market demands as stated above, Murata has developed more reliable materials, ensured product design margins, and established strict inspection standards for the production process to realize highly reliable products suited to use environments. In 2017, Murata succeeded in commercialization of lead type resin-coated MLCCs resistant to 200°C, and customers are considering adoption. Furthermore, various types of MLCCs according to the use environments have been commercialized, such as water-repellent products and MLCCs with metal terminals jointed.

Also in automotive MLCCs, Murata will continue to create new value for society by developing ceramic materials and improving process and inspection technologies toward creating smaller, more highly reliable and higher performance components.

Moreover, there is a strong desire in the automotive market for the stable supply of Murata's highly reliable components, and to respond to such expectations as the market leader, we are making maximum equipment investment at domestic and overseas plants. Murata will continue to deliver products with safety and security by identifying customers' product and supply needs as a continuously trusted company.

Murata capacitor field



## Strategy by product: Components

Net sales **1,105.0** billion yen

YoY Up **19.6%**

### Piezoelectric components



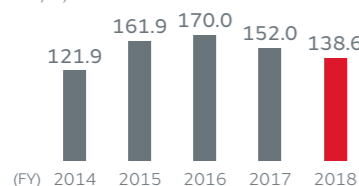
SAW filters

Main products SAW filters, Ultrasonic sensors, Resonators, Piezoelectric sensors, Ceramic filters, etc.



Net sales  
**138.6** billion yen  
YoY  
Down **8.8%**

Net sales (Billion yen)



#### Operating results

In fiscal 2018, sales of SAW filters declined owing to a decline in sales volume of high value added products for smartphones and lowered prices. As a result, overall net sales were 138.6 billion yen (down 8.8% year-on-year).

#### SAW filters

SAW devices are an essential component for eliminating communications noise to provide a smooth experience for enjoying online content on a smartphone. Murata's SAW devices, with the state-of-the-art technologies, are actively working inside various communication terminals including smartphones.

Murata has continued to lead the industry for a long time by making use of the R&D structures which can create unique technologies, and distribution channels seamlessly supporting the entire world. At present, Murata holds the largest production capacity in the industry, and has secured a global share of 50% of the SAW device market for communications applications.

With the 2020 Tokyo Olympic Games, 5G services with transmission speeds 100 times or more faster than current technologies will be fully commercialized, and the birth and expansion of new applications and communications devices is expected. With this trend, increasingly smaller and higher frequency SAW devices with superior composite performance will be a requirement. In response to this market demand, Murata will create compact products with superior features as soon as possible by utilizing proprietary I.H.P. technologies, TC-SAW technologies, advanced circuit simulation technology, etc. In addition, in terms of our future product line-up, we shall contribute to the development of society and industry by continuing efforts to differentiate our products from those of competitors and offer better products.

### Other components



Lithium-ion batteries

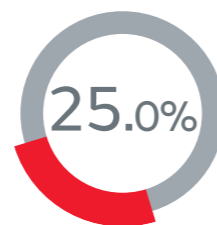


EMI suppression filters



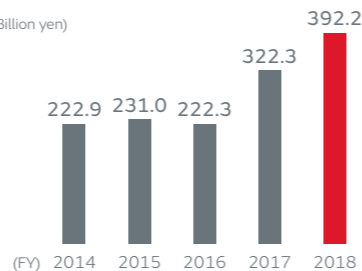
MEMS sensors

Main products Inductors (coils), EMI suppression filters, Connectors, MEMS sensors, Thermistors, Lithium-ion batteries, etc.



Net sales  
**392.2** billion yen  
YoY  
Up **21.7%**

Net sales (Billion yen)



#### Operating results

For fiscal 2018, this segment achieved substantial sales growth due to growth in demand for MEMS sensors for automotive electronics, despite sluggish sales of high frequency coils for high-end smartphones. Recording sales from the lithium-ion battery business also contributed to success, with the acquisition process being completed in September 2017. As a result, overall net sales were 392.2 billion yen (up 21.7% year-on-year).

#### Lithium-ion batteries

Murata's lithium-ion batteries are classified into three types: laminated, cylindrical, and coin type batteries. Laminated type batteries are mainly employed for mobile devices including smartphones as sizes can be freely changed owing to the laminate film exterior material. Murata's gel electrolytes have safety characteristics because they are leakage-free and do not easily swell compared to liquid electrolytes used by other companies. On the other hand, cylindrical type batteries have advantages particularly in high output applications widely used for gardening tools, power tools, electric bicycles, cleaners, and other fields. The use of coin type batteries for automotive applications and in the medical field is increasing, as their strengths of compactness and high reliability are utilized.

The competitive environment is expected to become increasingly fierce in the lithium-ion battery business, but Murata will address market needs by supplying products that combine safety and high output. In addition, by integrating storage battery modules equipped with cylindrical cells with power converter technology, etc. to provide an energy management system centered on the housing and industrial markets, we will promote utilization of natural energy.

In the future, we are planning mass production of fully solid state batteries, which are expected to act as next-generation batteries. We shall develop our business primarily around applications in areas such as wireless earphones and wearable devices, by applying the manufacturing technologies that we developed for multilayer ceramic capacitors.

#### EMI suppression filters

EMI suppression filters are electronic components that suppress unnecessary radio waves (noise) emitted by electronic devices. Noise is restricted by law and voluntary regulations in different countries, so measures to combat noise using EMI suppression filters are necessary to comply with these laws and regulations. Available types of EMI suppression filter include ferrite bead and other inductor types, LC composite filters and other built-in load capacitance, and common mode choke coils, and they are used in different ways in accordance with the type of noise

and conditions of the circuit.

In the in-vehicle system market, which we are focusing on as a growth market, electric vehicles and self-driving technology continues to advance, so the number of EMI suppression filters used in cars is expected to continue increasing in the medium-term, and we will further enhance our range of products for the in-vehicle system market. In addition, in the communications market, new types of noise that differ from previous types will be generated by 5G, so we will expand our range of filters specialized for different applications, to address new demand. Furthermore, we shall utilize our expertise gained in collaborative measures to combat noise at electromagnetic anechoic chambers in locations around the world to effectively develop and propose new products, while also offering solutions for combating noise tailored to different applications by utilizing our design support simulation software, as we look to become an "EMI solutions provider" that adapts to the times.

#### MEMS sensors

Murata MEMS sensors are highly reliable, stable, and precise even when used in difficult environments, owing to the combination of Murata's proprietary processing technologies, namely 3D-MEMS technologies, with design technologies and advanced circuit technologies. Many customers have favored these characteristics of Murata MEMS sensors, and they have been widely adopted in applications in automobiles, industrial devices, and medical devices.

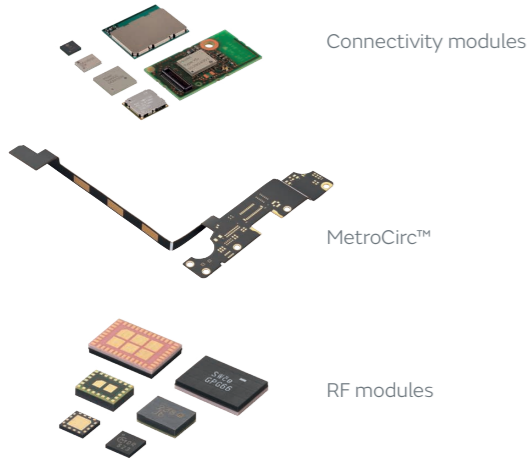
In the automotive field, which is growing rapidly, the use of stability control gyro sensors and acceleration sensors is increasing in line with the trend toward mandating the installation of safety systems to protect lives. In addition, preparing for the advent of the self-driving society in the coming years, support for safe driving and self-driving-related technology development is advancing on a global basis, resulting in an increasing range of business opportunities for us to utilize the strengths of Murata MEMS technologies as demand grows for locators to measure vehicle location, position, and direction of travel with greater precision.

In response to these market needs, Murata Manufacturing Co., Ltd., which has strengths in monozukuri (manufacturing), acquired the former VTI Technologies Oy (now Murata Electronics Oy), a Finnish company that we acquired in 2012, which has advanced technological capabilities related to MEMS development, thereby enabling us to offer more advanced products. We are also developing new products and increasing the supply capabilities of our factories in a timely manner. In the future, we will swiftly identify market needs and offer MEMS sensors that continue to be trusted and favored by our customers.

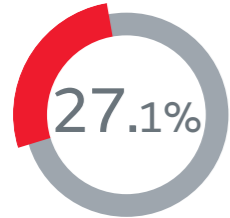
## Strategy by product: Modules

Net sales **466.7** billion yen  
YoY Up **5.1%**

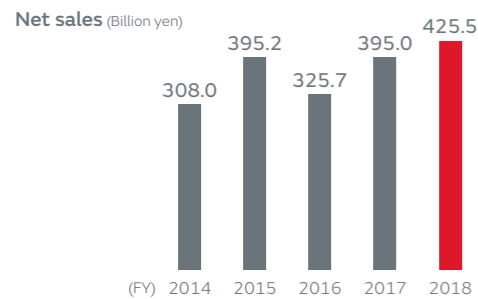
### Communication modules



Main products Connectivity modules, MetroCirc™, RF modules, etc.



Net sales  
**425.5** billion yen  
YoY Up **7.7%**



#### Operating results

For fiscal 2018, sales in multilayer resin substrates achieved substantial growth as they were used in a new model of high-end smartphone. In addition, sales in modules for communication equipment also increased. As a result, overall net sales were 425.5 billion yen (up 7.7% year-on-year).

#### Connectivity modules

Connectivity modules are compound components for wirelessly accessing the Internet or other devices from various devices.

These are used in various types of familiar devices such as smartphones, tablets, digital cameras, home appliances, and car navigation systems, and in various settings, including enabling users to download and upload photos and music from the Internet, and call hands-free while driving.

With the 2020 Tokyo Olympics, 5G services will be launched in Japan. 5G includes communications using microwaves on sub-6GHz bands and millimeter wave bands, namely 28GHz and 39GHz. Murata can offer high-property modules that use proprietary multilayer resin substrates to keep transmission loss low on millimeter wave bands.

Additionally, in an IoT society where all types of objects around us are connected to the Internet, various types of devices will have wireless communication functions. Murata will promptly supply products that are easy for customers to use for automobiles and edge devices for various applications, by utilizing design technologies with high reliability for smaller and higher performance products alongside software technologies to enhance connectivity, while contributing to the development of an IoT society as our mission in creating the future of electronics.

#### MetroCirc™

MetroCirc™ is a thinner multilayer resin substrate comprising LCP (liquid crystal polymer) sheets with exceptional RF characteristics in many layers which facilitates a flexible bending process.

It is possible to design circuits by inserting copper foil sheets between LCP sheets, and these circuits are used as transmission wires, coils, and other functional components in smartphones, wearable devices, and other applications, contributing to smaller, thinner, and higher performance devices.

Millimeter waves and other high frequency waves are used in 5G, for which service will be launched this year and next year, so it may be expected that MetroCirc™ will be used in substrates for millimeter wave modules, millimeter wave transmission lines, and other applications that utilize the low transmission loss properties at high frequencies that is a feature of MetroCirc™.

In addition, we believe that there will be more opportunities for customers to favor MetroCirc™ as the frequencies used become higher, because this will further highlight MetroCirc™'s competitive superiority in terms of transmission loss compared with competing technologies.

Looking ahead, it is likely that customers will face

more issues related to high frequency communications as the number of devices using 5G increases.

MetroCirc™ will contribute to resolving customers' issues, through the combination of high performance materials and Murata's unique ideas, developed based on our multilayer technology.

#### RF modules

Murata's RF modules are multifunctional and high performance electronic component units that realize an analogue high frequency circuit that controls communications among wireless devices by integrating various key devices.

This module is comprised of passive devices such as SAW filters which demultiplex high frequencies and LC filters, high power amplifiers in transmission, low distortion amplifiers in reception, antenna changeover switches, and other semiconductor devices, and is actively used for various types of wire-

less devices including smartphones and tablet PCs.

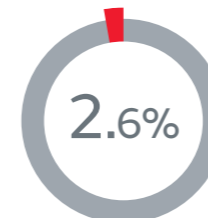
Murata, which internally develops various key devices that form the basis for module configuration and package technologies for modularization, is able to carry out integrated production. As a result, Murata has a strong competitive advantage in terms of business speed, production capability, and quality, in addition to performance.

With the arrival of 5G, RF modules for realizing dual connectivity in addition to multiple frequency bands and carrier aggregation will become necessary. In addition, the modularization of electronic components is expected to advance in line with the miniaturization and increased functionalities of wireless devices. Murata will promptly identify future market and customer needs, while also leveraging our competitive advantages to propose RF modules most suitable to customers, as we aim to be a company selected by customers.

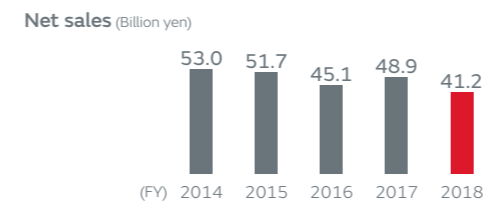
### Power supplies and other modules



Main products Power supplies, etc.



Net sales  
**41.2** billion yen  
YoY Down **15.6%**



#### Operating results

For fiscal 2018, sales of power supplies mainly for office equipment decreased. As a result, overall net sales were 41.2 billion yen (down 15.6% year-on-year).

#### Power supply modules

Changes in the business portfolio of power supply module business are currently underway. Murata continues in its process to divest the conventional custom power supply business and aims to develop high value added products by utilizing Murata's strengths as differentiating factors.

Murata's power supply modules featuring high reliability, high efficiency, and high power density are used for markets including servers, datacom, communications devices, in-vehicle systems, and industrial electrical equipment.

In the future, 5G service will be common in the communications device market where data traffic will increase from the expansion of big data. Also, in the in-vehicle system market, as the range of electronic components grows with higher functionality, highly efficient, compact power supplies with higher power density will increasingly become requirements.

To meet these market demands, Murata will provide compact power supply modules developed by integrating power circuit technologies, RF technologies, self-manufacturing of key devices, and highly reliable packaging technologies accumulated over many years. In addition, by providing highly efficient, high power density power supply systems as solutions that combined power supply modules and batteries, we will contribute to both increased functionality and energy saving of electronic devices.