

# Technologies

For Murata to continue to create new value, we must keep innovating technologies constantly. Murata has built an integrated system of production from raw materials to finished products and is developing technologies into platforms so that we can independently research, develop, accumulate, and apply a fundamental technology base to product development. In addition, we proactively collaborate with outside parties with the aim of creating new markets and innovations.

## Introduction of the R&D framework

Murata has built an integrated system of production from raw materials to finished products. The Company's research and development activities also range from materials development to product design technology development, production technology development, software development, and analytical technology development. We strive to improve group-wide development efficiency by developing acquired elemental technologies as platforms and rolling them out across the Group. We also actively conduct joint research with external research institutions and are acquiring new technologies in anticipation of the future.

In recent years, our focus has been particularly on the communications and automotive markets, but going forward, in addition to these markets, we will focus on the energy and healthcare/medical markets and develop technologies for those areas.

In the Components segment, we are driving the development of multilayer ceramic capacitors, noise suppression products, supercapacitors, timing devices, sensor devices, RF components, batteries, RFID, etc., with the key words of miniaturization, slimming-down, and higher heat resistance. In the Modules segment, we are driving the development of communication modules, power supply modules, multilayer resin substrates, etc., with the key words of miniaturization, higher functionalities, multi-functionalization, and lower power consumption. In the

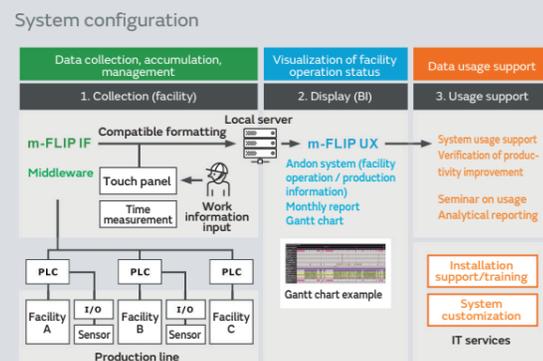
Research and Development Department, we are developing new technologies and products especially for the automotive, energy, healthcare/medical, and IoT markets, with the goal of cultivating new markets and driving innovation.

Murata's research and development framework consists of the Corporate Technology & Business Development Unit, Production Engineering Unit, Components Business Unit, Module Business Unit, and Medical Products Department. The business units and business promotion departments are mainly engaged in technological development for product types that they oversee, and the development of new products. The Corporate Technology & Business Development Unit and Production Engineering Unit mainly focus on technological development for new business creation, as well as the development and platform creation of elemental technology.

As a new research and development base for further value creation, the "Minato Mirai Innovation Center" is scheduled to be built in September 2020. At the Minato Mirai Innovation Center, we plan to reinforce basic research, planning, designing, and construction capabilities of products targeted for focus markets such as automotive, energy, and healthcare/medical, and products targeted for new markets such as IoT, in addition to existing businesses centered on the communications market.

## Murata's initiative: m-FLIP™ (muRata Factory Line Integration Platform)

Murata is also advancing the platform creation of production processes. m-FLIP™ is a productivity improvement platform that leverages Murata's many years of experience. We have developed software and human services to promptly find solutions for improvement by visualizing various data and effects such as detailed information on facility operation and a monthly report app.



## Platform technologies

### Materials technology

"New electronic devices begin with new electronic components; new electronic components begin with new materials..." Based on this idea, we have been successfully creating materials with superior properties by always returning to materials and taking a strong stance on managing required functions and development at the source.

### Front-end process technology

Front-end process technologies make it possible to produce designed functions concretely in the best possible ways. They play important roles in miniaturizing, slimming down, and enhancing the functionalities of electronic components.

### Product design technology

From single-function components to modules and on to total solution proposals, the value that Murata has provided over the years continues to evolve. We develop technologies and products that can promptly respond to customer needs with an eye on the future.

### Back-end process technology

Thanks to our internally designed production facilities and manufacturing ("monozukuri") expertise, we possess numerous technologies and know-how in regard to mass producing products efficiently and stably.

### Analytical technology

Efficient use of scientific analytical methods to confirm physical and electrical properties, composition, and structures of materials, together with Murata's advanced failure analysis systems, provide peace of mind to our customers.

## Platforms

Materials technology	Materials design	Materials processing
Front-end process technology	Laminating & stacking	Printing
Product design technology	High frequency design	Device design
Back-end process technology	Packaging	Measurement
Analytical technology	Materials characterization	Failure analysis

## Core competencies

### Materials technology

Murata has established technologies to precisely control ceramic materials and electrode materials that determine the properties of components. By incorporating organic materials, we are also creating new value from the development of new materials.

### Production technology

We have developed and manufactured our original equipment to maximize the utilization of materials technologies. Production lines and facilities that match product concepts are enhancing Murata's competitiveness.

### Lamination technology

We have refined the technology of forming ceramic materials into thin sheets and stacking them on many layers. We respond to our customers' expectations with this high-level technology.

### RF technology

Murata's RF technology supports the innovation of rapidly-evolving mobile devices. Modules designed with Murata's proprietary technologies contribute not only to wireless data transfer but also to wireless power supplies, supporting tomorrow's communications.

Murata strives to develop these elemental technologies.

By fusing these elemental technologies, we will expand our product lineup and facilitate the development of new products, as well as respond to the expectations of our markets and customers.