

ADVANCED DEVICES

Creating and growing businesses that solve issues faced by society and customers beyond the mobility domain

As a company reorganized to go beyond technologies and focus more on helping society and our customers, we are collaborating on the sensing and actuation fronts, and enhancing the value of systems through semiconductors that leverage our strengths derived from vertical integration. While creating new devices and systems, we aim to win the trust of our customers with an all-points approach to quality, cost, and delivery (QCD) in the expanding electrification market.

Relevant
SDGs

7
AFFORDABLE AND
CLEAN ENERGY

9
INDUSTRIAL INNOVATION
AND INFRASTRUCTURE

13
CLIMATE
ACTION



Eiichi Kurokawa
Head of Business Group

Business Strengths

Creation of New Value with Sensing and Actuation

Within the business group, our core technologies in actuation (i.e., hands and legs) are combined with semiconductors (i.e., brains) and sensing (i.e., eyes) to create new devices and systems based on nimble concepts, enabling the development of “great-if-possible” solutions for issues faced by our customers.

Robust Semiconductor Supply Capabilities Based on In-house and Consignment Production and Partnerships

In preparation for expansion in the electrification market, DENSO will internally produce silicon (Si) and silicon carbide (SiC) power semiconductors, which are key devices that incorporate world-first technologies. Moreover, we will build the supply chain needed to increase cost competitiveness and supply capabilities.

On-site Capabilities That Support Production Technologies Highly Resilient to Changes in Specifications and Volumes in New Product Domains

DENSO is broadening the scope of applications for new product domains where it is competitive, thanks to human resource development and handpicked young employees. DENSO leverages digital-twin technology and collaborative robots to build a production system that can be optimally organized and configured by changing production line shapes and locations in accordance with fluctuations in volumes for new products.

Business Strategy

We will formulate winning scenarios and create new businesses through outstanding technological capabilities, speed, and alliances.

Bold Pursuit of Work Grounded in the DENSO Philosophy	To steadily transform our business portfolio from internal combustion engine products toward products for CASE vehicles, we will build variable-mix, variable-volume production lines that can adapt to product replacement and business environments with significant volume fluctuations. In addition, by digitalizing the expertise and knowledge of operators, we will take on ambitious production innovations that facilitate unmanned and nonstop production and compensate for a decline in the working age population.
Realization of Carbon Neutrality	As the presence of BEVs increases, we will capture demand in the vehicle electrification market through a two-pronged strategy of continuing our existing in-house production of inverter systems while establishing a business for the provision of modules catering to customers’ growing preference for producing inverters in-house. Also, we believe that the key to competitiveness will be the establishment of supply capabilities for the SiC used in BEVs. Going beyond conventional approaches, DENSO will efficiently and swiftly build a broad-based supply chain.
Creation of New Value	<p>The use of batteries is diversifying from primary to secondary usage as the introduction of BEVs gathers momentum. Given this trend, we believe that predicting battery life and reducing fire risk are important tasks. Through collaboration with other companies, DENSO will create and realize the widespread adoption of its differentiated products for sensing the health of batteries over their lifetimes, thereby providing additional safety and peace of mind when reusing and recycling batteries.</p> <p>We will identify the changes in electronic platform-related demand—which are accompanying the evolution from function-specific ECUs to the division of vehicles into multiple zones and the use of large-scale integrated ECUs controlled by central ECUs—and use semiconductor technologies to help enhance the value of systems. At the same time, DENSO will achieve business growth by increasing supply stability through alliances and outsourcing. In addition, we will support vehicle electrification by setting our sights on 2030 and accelerating the development of products for the next generation and beyond and by leveraging vertical integration to expand our lineup of control integrated circuits (ICs) for power semiconductors.</p> <p>We aim to establish multiple businesses in such areas as electric drives, human–machine interface, and thermal management as well as in non-mobility fields, including agriculture and plant logistics. In the CASE field, through the use of sensors and auxiliaries, DENSO will enable analysis of the energy management of individual vehicles and the optimization of system efficiency not only for such main components as batteries, motor generators, and inverters but also for other components. In these ways, we will benefit customers and society.</p>

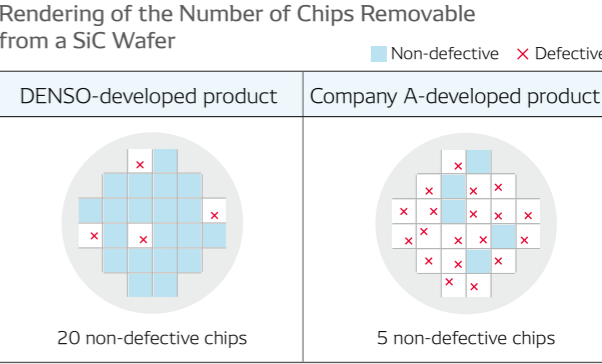
Business Analysis Q&A

Q: Why is DENSO promoting in-house production in the field of semiconductors, where technology is evolving rapidly? Also, are there any fields in which you intend to strengthen your relationships with other companies?

A: As environmental regulations become stricter worldwide and vehicle electrification progresses, inverters with silicon carbide (SiC) semiconductors, which have lower power loss, higher quality, and larger areas, have a significant advantage in the electric vehicle market. DENSO will produce differentiated SiC semiconductors by using its proprietary “gas method” manufacturing technology, which is 15 times faster and 30% less costly than conventional manufacturing methods.

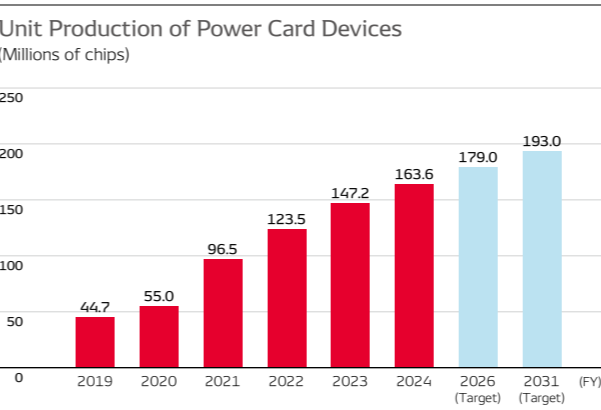
In addition, to ensure stable procurement of semiconductors in the medium to long term and strengthen our supply capacity, we are working on in-house production and alliances with partners. As part of these efforts, we are considering even further alliances. For example, in fiscal 2024 we decided to invest \$500 million in the U.S.-based Coherent Corp.

By developing high-quality, low-cost technologies in-house and collaborating with optimal partners, we are maximizing our competitiveness.



Objectives and Results of Strategies for Green and Peace of Mind

Objective: Accelerate the vertically integrated development of power semiconductors
Results: Amid an in-vehicle semiconductor market that is likely to increase 3.5 times in size between 2020 to 2030, as a Tier 1 company, supported the evolution of vehicles by strengthening fundamental technologies for semiconductors; anticipating the progress of BEVs, particularly in the electrification field, accelerated the introduction of SiC power semiconductors, which help enhance electric mileage; and, through the optimization of in-house production and alliances, vertically integrated SiC wafers, epitaxial wafers, and devices, thereby realizing lower loss, fewer defects, and greater speed and helping customers enhance product competitiveness



Helping Extend BEV Driving Distances

SiC power semiconductors:
Power losses approximately 70% lower than conventional Si devices

Inverters drive and control the motors that power BEVs. Compared with inverters that use conventional Si power semiconductors, our inverters that use SiC power semiconductors in their drive devices reduce power loss by approximately 70% under certain driving conditions. Consequently, our SiC power semiconductors help extend the driving distance of BEVs by increasing their electric mileage.

Resolving Social Issues through Our Businesses

Addressing Labor Shortages through the Commencement of a Verification Test of In-plant Automated Conveyance (Telemotion) Enabled by Sensing Technology

We are creating new solutions by connecting core sensing and actuation technologies that we have developed in the automotive field. For example, mindful of the shortage of workers due to an aging population, we are developing systems that help automate the in-plant conveyance of products. In-house, we have developed a highly accurate and reliable light detection and ranging

(LiDAR) sensor that detects the three-dimensional shape of objects. Through very precise detection and recognition of transportation routes and obstacles in plants, our three-dimensional LiDAR sensor will help automate object conveyance normally performed by humans, offset the shortage of plant workers, avoid the need for long working hours, and enhance productivity. We have already begun verification tests of a conveyance system in collaboration with Toyota Motor Corporation.