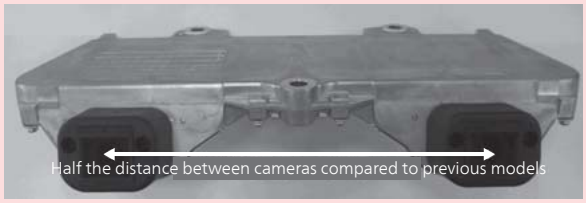
Automotive Systems

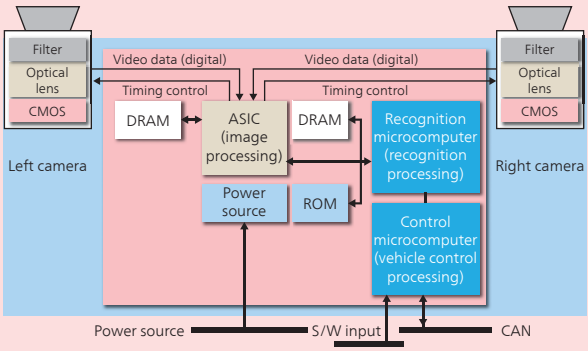
1 Compact Stereo Camera

Hitachi Automotive Systems, Ltd. supplies stereo cameras to automakers as sensors for advanced driver assistance systems that are able to recognize the outside world and the vehicle's driving conditions. These systems are intended to prevent car accidents and mitigate damage by detecting pedestrians and bicycles, etc. and controlling the brakes.

The latest compact stereo camera developed by Hitachi only requires about half the distance between the left and right cameras (baseline length) compared to previous models. This enables the stereo camera to be installed even in restricted layout conditions, such as in compact vehicles, yet achieves almost the same performance as before in terms of accident prevention and damage mitigation.

In the future, Hitachi will continue to enhance performance and promote further adoption by reducing costs and developing sensors that will help make automatic driving a reality.
(Hitachi Automotive Systems, Ltd.)

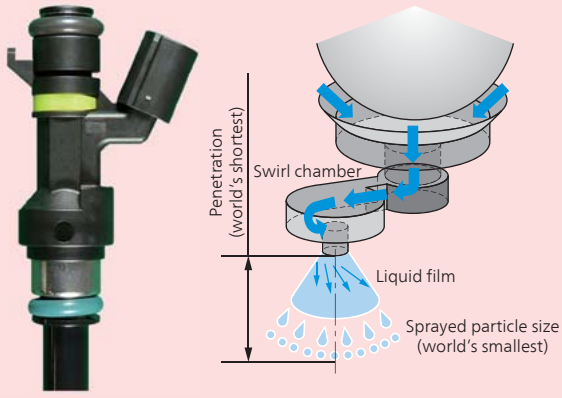




Item	Specifications (developed product)
Size	Width: 270 × Depth: 130 × Height: 40 (mm)
Weight	650 (g)

CMOS: complementary metal oxide semiconductor, DRAM: dynamic random access memory, ASIC: application specific integrated circuit, ROM: read only memory, S/W: switch, CAN: controller area network

1 Compact stereo camera exterior (top), structure (middle), and specifications (bottom)



2 Multi-swirl injector for PFI and spraying system

2 Multi-swirl Injector for Port Fuel Injection

The multi-swirl injector for port fuel injection (PFI) is a gasoline injector used in PFI systems. To achieve greater atomization of the injected gasoline particles and low penetration (low spray speed), it employs the world's first*1 swirl spraying system.

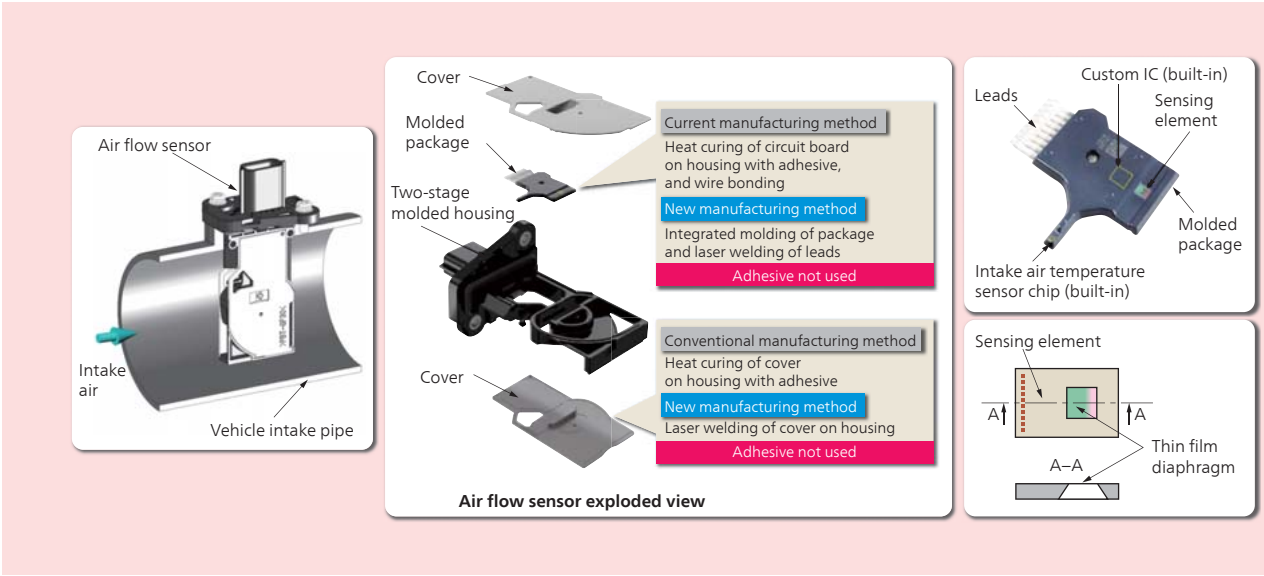
In this swirl spraying system, energy is gained by swirling the gasoline in a swirl chamber located in the fuel passage, and this energy is converted efficiently into atomization energy for spraying. To enable the adoption of this spraying system, Hitachi developed spray control technology using its proprietary simulation technology and precision processing technology. The result was a spraying method that achieves both the world's smallest*2 particle size and the world's shortest*2 penetration. This spraying system improves fuel efficiency and reduces exhaust gas emissions.
(Hitachi Automotive Systems, Ltd.)
(Start of mass production: November 2013)

*1 As of October 2013, research by Hitachi Automotive Systems.
*2 As of October 2015, research by Hitachi Automotive Systems.

3 Molded Package Air Flow Sensor

An air flow sensor measures the flow of intake air into an internal combustion engine. With the goal of supplying high-precision sensors at low cost, Hitachi has developed a new type of air flow sensor based on a molded plastic package instead of the printed circuit board that was previously required.

Specifically, the following four areas were developed for product application.



3 Molded package air flow sensor

(1) A custom integrated circuit (IC) that internally integrates the external electronic components that were previously required
(2) A sensing element formed from a thin film diaphragm a few micrometers thick that is partially exposed and integrated and sealed in a molded plastic package together with the IC and intake air temperature sensor
(3) A two-stage molded housing that fixes the package to the housing without using adhesive
(4) Technology that joins the plastic cover using a laser, without using the adhesive that was previously required

As a result, element mounting accuracy is improved, achieving higher sensor precision. In addition, the number of components has been greatly reduced, and the manufacturing time has been shortened through the elimination of processes such as adhesive heat curing process.

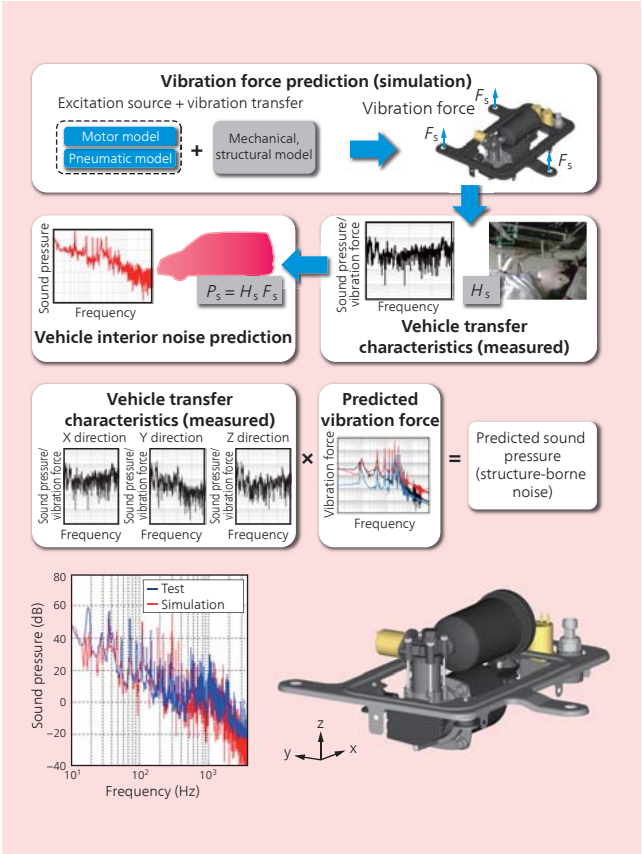
In the future, Hitachi will continue to improve performance and further integrate components to develop optimum sensors for high performance engines.
(Hitachi Automotive Systems, Ltd.)
(Start of production: April 2014)

4 Vehicle Interior Noise Prediction Technology

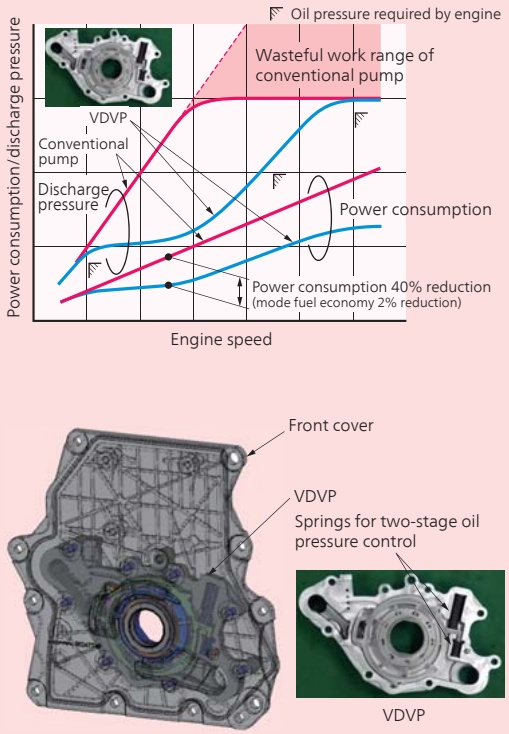
In recent years, there has been growing need to reduce the noise of components to make vehicles more quiet. However, even if the noise is reduced for a component alone, the noise level may not be satisfactory once the component is actually mounted on a vehicle. In response to this issue, Hitachi is developing a method for predicting, at the development stage, what the noise level of components will be when they are mounted on a vehicle. This kind of approach is called analysis lead design.

Applying this method to the air suspension compressor, the vibration of the compressor itself during operation was analyzed to calculate the force of vibration that would be applied to the vehicle. By multiplying this by the vehicle transfer characteristics, the vehicle interior noise (sound pressure) can be predicted. The vehicle transfer characteristics can be calculated by applying vibration force to a mass-produced vehicle or development vehicle and measuring the sound pressure inside the vehicle. As long as the vehicle transfer characteristics are available, the vehicle interior noise when a component is mounted can be predicted in the analysis.

In the future, Hitachi will continue to improve the accuracy of this technology to enable application in a wide range of products.
(Hitachi Automotive Systems, Ltd.)



4 Overview of vehicle interior noise prediction method (top), results of vehicle interior noise simulation (bottom)



5 Characteristics of VDVP oil pressure and power (top), VDVP integrated into front cover (bottom)

5 Variable Displacement Oil Pump for Engine Lubrication

In recent years there has been growing demand for variable displacement oil pumps for engine lubrication to improve fuel efficiency in response to stricter environmental and fuel efficiency regulations. To meet such demand, Hitachi has developed the variable displacement vane pump (VDVP), a variable displacement oil pump that is integrated into the front cover.

In conventional pumps with a constant discharge capacity, the discharge capacity and discharge pressure both increase as the engine speed increases. In high engine speed ranges, more oil pressure is generated than is required by the engine. The oil pressure must be controlled to an appropriate level by releasing excess oil to the oil pan via a relief valve. In other words, the problem with this method is that wasteful work is performed.

The newly developed VDVP can vary the discharge capacity, eliminating the excess oil that needs to be released in conventional pumps. In addition, the use of two springs enables the oil pressure to be controlled in two stages from low engine speeds. This improves fuel efficiency by 2% compared with conventional pumps in the mode fuel economy range (40% power consumption reduction).

In the future, Hitachi will continue to enhance its product lineup to meet global customer needs.

(Hitachi Automotive Systems, Ltd.)

(Start of mass production: October 2014)

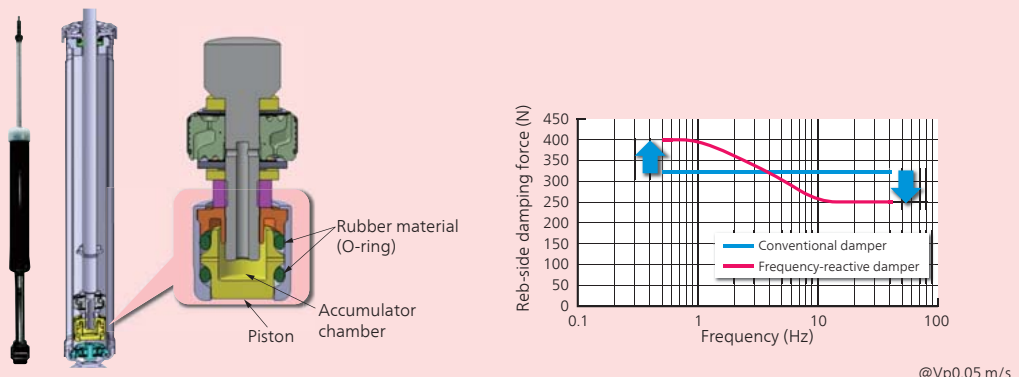
6 Frequency-reactive Damper

A recent trend in vehicles is the adoption of tires with larger diameters and lower profiles, and environmentally conscious tires with higher rigidity. This has resulted in reduced ride comfort due to the uncomfortable vibrations (harshness) that are transmitted to the vehicle when driving on variable road surfaces. However, it is difficult for conventional dampers to restrict the large low-frequency bouncing movements of the vehicle (by increasing the damping force) and to stop the uncomfortable high-frequency vibrations that are transmitted from the road surface (by reducing the damping force) at the same time.

Hitachi has started to mass produce frequency-reactive dampers that can both restrict and stop vibrations by changing the damping force according to the vibration frequency. This is achieved using a mechanical structure, without using electronic control. A piston-type accumulator chamber is installed within the oil passage of the damper, and both spring and sealing functionality is provided with a simple rubber material. This achieves variable damping force characteristics with minimal discomfort, and enables the mechanism to be made more compact.

In the future, Hitachi will meet customer needs by further improving performance, enhancing the product lineup and applying the technology to more vehicle types (expand to compact vehicles).

(Hitachi Automotive Systems, Ltd.)



6 Frequency-reactive damper

Item	Specifications
Size (mm)	120×80×12
Weight (kg)	0.24
Average voltage (V)	3.7
Capacity (Ah)	5.2
Power density (W/kg)	5,000
Energy density (Wh/kg)	80

7 Prismatic lithium-ion battery cell and specifications

7 Prismatic Lithium-ion Batteries for Hybrid Vehicles

Hitachi Automotive Systems, Ltd. will supply prismatic lithium-ion battery cells with a high power density of 5,000 W/kg for the new model Chevrolet Malibu Hybrid to be sold by General Motors Company in 2016. The batteries are manufactured by Hitachi Vehicle Energy, Ltd.

These prismatic lithium-ion battery cells conform to high safety standards while achieving a high power density of 5,000 W/kg by using a heat-resistant separator that ensures ion conductivity between the positive and negative electrodes of the battery cell. Evaluations have also shown that these batteries maintain their high power density even under cold conditions of -30°C, which was a reason for their adoption in this model.

In the future, Hitachi will further expand the global presence of these prismatic lithium-ion battery cells to respond to customer needs, as well as strengthen its electric power train products to contribute to the development of electric vehicles.

(Hitachi Automotive Systems, Ltd., Hitachi Vehicle Energy, Ltd.)

8 Android Onboard Device for Commercial Vehicles

Clarion Co., Ltd. released its new series of onboard devices for commercial vehicles in November 2014. These devices use the Android operating system (OS), which enables a wide range of applications to be added depending on the type of business, and are installed on a platform that is tough and durable. Clarion responded to strong demand from the market for commercial vehicle onboard devices with such features.

The main features are as follows.

(1) Supplies accurate positional information using external navigation control and multiple sensors, and a tough and durable design can withstand continuous use 24 hours a day, 7 days a week.

(2) A software development kit is provided to simplify the development of third-party applications.

(3) Can be used for communicating data with a center that uses the driving log acquisition function (positional information, time, vehicle data, etc.) required for safe driving analysis and movement management, and to support business management by storing driving logs in universal serial bus (USB) memory.

(4) The car navigation and Internet protocol (IP) wireless functions are integrated by connecting a USB stick-type data communication device and a push-to-talk (PTT) microphone.

In the future, Clarion will continue to apply its know-how in business-use car navigation to develop onboard devices for commercial vehicles that support safe and economical driving, as well as business efficiency.

(Clarion Co., Ltd.)

8 Android onboard device for commercial vehicles