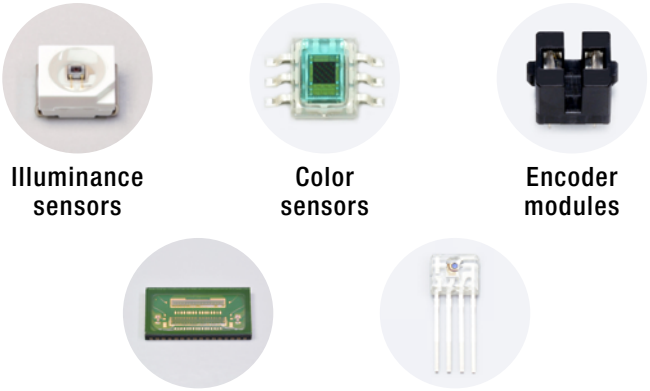
HAMAMATSU

PHOTON IS OUR BUSINESS

Photonics enhances vehicle safety and comfort

In today's modern cars, many features are designed to support drivers on their journeys all over the world. Working in the background and invisible to most, some of these hidden components provide us with increasing comfort and safety no matter the driving conditions. EU regulations are becoming stricter with new 2022 regulations* for advanced safety systems aiming to improve the safety of both occupants and vulnerable road users. Ultimately, technology will play a key role in achieving the EU's long-term goal of moving close to zero fatalities and serious injuries by 2050.

Hamamatsu Photonics, a leading expert in optoelectronic technology, develops high-quality optical sensors for the automotive industry. With over 35 years of experience in this industry, it has grown to understand the specific challenges faced by developing capabilities in customization to cater to customers' requirements and ensuring reliability thanks to testing in its manufacturing facilities and the highest quality with its AECQ qualification.



Illuminance sensors | **Color sensors** | **Encoder modules**

Photo sensors with front-end IC | **Photo ICs for optical links**

A peak at Photo ICs' variation throught Hamamatsu's wide product range.

Hamamatsu has grown its portfolio with diverse advanced technologies to assist in safe, reliable, green, and comfortable car driving. Out of the range of automotive devices offered, photo ICs (integrated circuits) are a key component that come in many shapes and forms but prove essential for many light-sensing automotive applications.

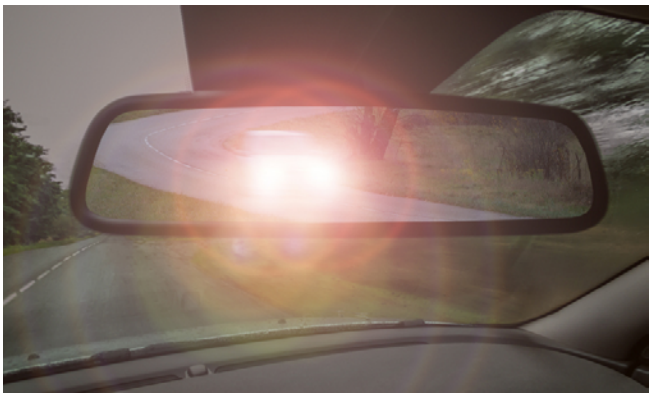
Photo IC is an intelligent optical sensor with diverse functions that integrate a photodiode with signal processing IC in the same package. Hamamatsu designs all types based on the mounting environment and application needs. These compact and lightweight devices can serve, be adapted, or integrated to function as illuminance sensors, color sensors, encoder modules, photo sensors with front-end ICs, and photo ICs for optical links.

See the light

To detect the ambient light level, **illuminance sensors** are ideal. These sensors are built for excellent linearity and a large dynamic range with five orders

of magnitude, in order to detect low light levels in the dark, as well as bright daylight. Smart auto headlights respond to the ambient light level to automatically turn the headlights of a car on or off. An illuminance sensor mounted near the dashboard monitors the brightness outside the car and turns on the parking lights or headlights when the brightness drops below a certain light level.

Auto anti-glare rearview mirrors also have an illuminance sensor that automatically adjusts the mirror reflectance when it detects intense light (high-beam headlights) from a rear-approaching car at night, so that the driver is not dazzled by the headlight glare.



Also providing comfort, **color sensors** help give information on brightness or color functions for displays, dashboards, and interior lighting, for example, dimming of the head-up display. Interior illumination according to certain situations or moods is one of the big topics for car manufacturers today. Scientific studies show that light influences the mood and the condition of the driver.
Adjustment of brightness or color can support the driver to remain attentive while driving. Special filters are used to achieve sensitivity close to the human eye. RGB sensors improve the categorization of the measured light, in order to distinguish the different times of the day, weather conditions, or between natural and artificial light sources. Also, **encoder modules** can be found in electric power-assisted steering motors, electric brakes, and traction motors, to send accurate speed and direction signals to the car's control systems.

Optical data transmission

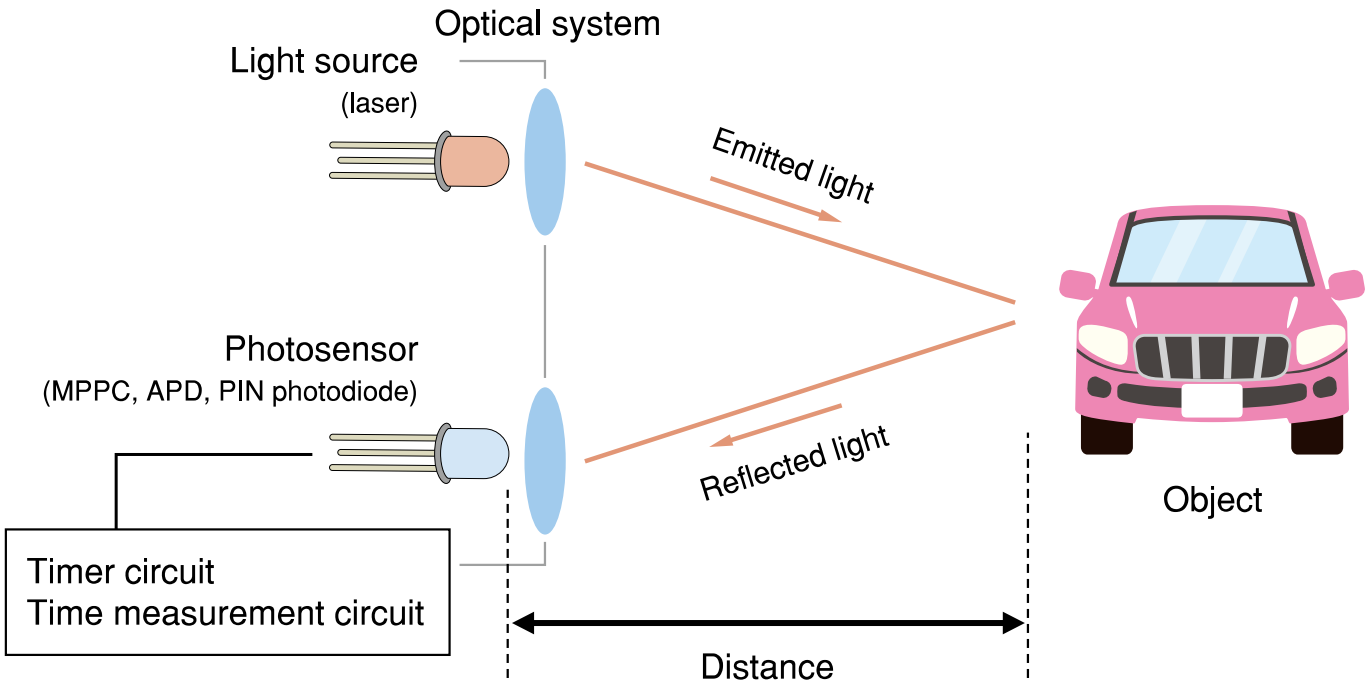
With the heavy increase of sensors in today's vehicles, a large amount of data is sent to the central unit board for processing. Once processed, the data is transferred to the vehicle's network. This network can be split into safety networks (cameras, mm-wave radar, LiDAR, etc.), control networks (engines, brakes, etc.), and information networks (car navigation, video, audio, etc.).

In parallel the industry is shifting towards electric vehicles with more batteries and electric components inside the motors. This means that modern cars need to communicate even more information in a very fast time and without electromagnetic impacts.

To match the needs of these modern vehicles, the ideal solution is an optical network. This network uses plastic optical fibers composed of photo IC for optical links. Hamamatsu Photonics equips manufacturers with Hamamatsu Fiber Optical Transceivers and there are plans to use optical networks for ADAS*3 networks, including for automatic braking. We are also currently working to develop FOT for optical networks that are 1 Gbps or even 10 Gbps and faster.

A look at automotive LiDAR

One of the most promising developments in recent years has been the use of LiDAR (Light Detection and Ranging) systems, an optical method aimed at measuring distances and speed. It measures distance by emitting laser light to a target and detecting its reflection with the photosensor. It is increasingly important in today's safety measures as it helps us detect obstacles and avoid collisions. **Photo sensors with front-end IC** intervene by optically measuring the distance from the car in front and controlling the distance between vehicles. However, these are only one of the many solutions offered by Hamamatsu for TOF (Time-Of-Flight) and FMCW (Frequency-Modulated-Continuous-Wave) LiDAR requirements. Please view our full range of solutions here: www.hamamatsu.com/eu/en/applications/automotive/lidar



LiDAR for automobiles mainly uses the direct TOF method. This method calculates the distance by calculating the length of time for a light pulse to travel from its light source, be reflected off an object, and return to the sensor.

Finally, tackling environmental challenges is also at the forefront of the automotive industry. **Photo ICs for optical links** can be useful to help monitor and control the current, voltage, temperature, and functionality of each individual battery cell in order to ensure the best reliability and performance of the battery pack. Additionally, multimedia information including video and audio data we enjoy in a car is sent via a wire harness or optical fiber cable between various devices such as a display, in-car camera, audio player, and speakers. Light emitter and receiver photo ICs are used for such information exchange through optical links using optical fibers.

From design to manufacturing, Hamamatsu delivers standard and customized solutions with high-volume manufacturing capabilities. Please contact Hamamatsu Photonics for all your automotive needs now and in the future.

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Reference

*Road safety: Commission welcomes agreement on new EU rules to help save lives (europa.eu)