Semiconductor

EFFICIENT APPLICATION SOLUTIONS

SICK
Sensor Intelligence.

CHALLENGES IN THE SEMICONDUCTOR INDUSTRY

In line with Moore's law, the semiconductor industry has doubled the number of transistors in each integrated circuit approximately every 18 months for more than four decades now. This trend is the result of rapid innovations in production processes that are showing no signs of abating. As a result, production plants both today and in the future need to be equipped with state-of-the-art sensors in order to satisfy the stringent requirements that semiconductor manufacturers place on product quality and cost-effectiveness. SICK sensor technology has proven ideal for use in the semiconductor industry, consistently offering solutions that are perfectly matched to all kinds of applications – whether they involve complex front-end processes, back-end applications, or wafer fab automation.


➔ www.sick.com/Semiconductor

Detecting and measuring

The semiconductor industry places very high demands on detection and measuring tasks. The task is to detect the smallest parts, such as bonding wires or challenging surfaces of semiconductor wafers. At the same time, sensors in many process machines are exposed to harsh environmental conditions. These include contact with chemicals, high temperatures and even vacuum environments. Thanks to a wide range of technology, sensor solutions from SICK easily master these challenges.

Protection

To protect people and processes, not only machines must be protected in the semiconductor industry. Safety technology is used in autonomous logistics processes as well. SICK supports semiconductor and system manufacturers with a broad range of safety solution technology. SICK also supports its customers with a comprehensive service package which includes consultation and assistance with commissioning as well as training and education.
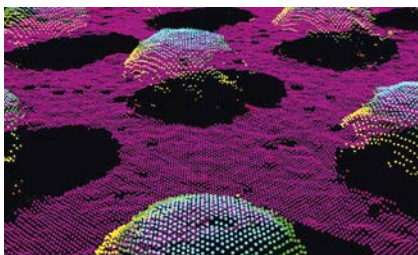
Monitoring and controlling

Semiconductor wafers and chips must fulfill very high quality demands. The very small structures on semiconductor wafers and chips require highly accurate measurements from quality control solutions. Vision sensors and high-resolution displacement measurement sensors ensure that test and inspection systems meet these requirements

Identifying

Reliable object identification is a requirement for smooth production flow and forms the basis for traceability and continuous quality improvement. SICK offers a wide range of both permanently installed and mobile readers for bar codes, 2D codes and RFID technology.

HARSH AMBIENT CONDITIONS IN THE SEMICONDUCTOR INDUSTRY

High resistance to temperature
Special production processes must take place under the influence of high temperatures. Temperatures of 100 °C and higher can be required for this. In these processes or even in adjacent production environments, sensor solutions are required which are not harmed by use at these temperatures.
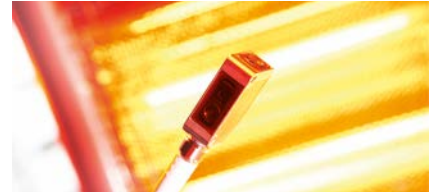
Chemical resistance
Chemicals can either be used as part of the end product, such as the electrolytes in a battery, or as corrosion aids or in other chemical processes, for example in the solar and semiconductor industry.Sensors which are exposed to these chemicals must have housing made of very resistant materials. While a stainless-steel housing is sufficient in some cases, special materials like Teflon have to be used for very aggressive chemicals.

Vacuum resistance
Vacuum chambers and vacuum environments create critical ambient conditions for automation components. Among other things, a vacuum can lead to so-called outgassing. This refers to the escape of gases, which can negatively affect product quality in the worst case scenario. Special materials and production processes must be used to prevent this.

NAVIGATION TECHNOLOGIES FOR MOBILE APPLICATIONS

Line guidance
Thanks to their principle of operation, line guidance systems are particularly easy to integrate and can be commissioned quickly, which makes them the number one choice for AGV applications of low complexity.
In the case of optical or magnetic line guidance, reference marks are placed on the ground/floor which are detected and evaluated by sensors as the vehicle passes over them. Besides the actual reference direction, further information can be read and transmitted via the floor markings.

Grid localization
In warehouse logistics, automated guided vehicles must move freely without being bound to lanes. Marker-based localization solutions are particularly suitable for material handling due to the dynamic nature of these applications. They are usually based on optical or magnetic markers that are applied to the ground/floor and are detected by a sensor on the vehicle as it travels over them.

Map-based navigation
In the case of map-based navigation, the vehicle uses a digital representation of the environment. The map contains the geometric data for the environment including all contours that the sensor used can "see". These can comprise not only the natural features in the environment, but also artificial landmarks such as reflectors. The vehicle can localize itself by comparing the current sensor data with the stored map and thereby determine its position.

DETECTING AND MEASURING

Positioning of trays on a loader/unloader

To enable the robot to accurately perform its gripping operations and avoid collisions with the components, the trays are positioned highly precisely on a loader/unloader with the help of a W4SL-3 miniature photoelectric sensor with reflector. The precise laser light spot of the photoelectric sensor ensures a highly accurate switching behavior.

➜ www.sick.com/W4SL-3
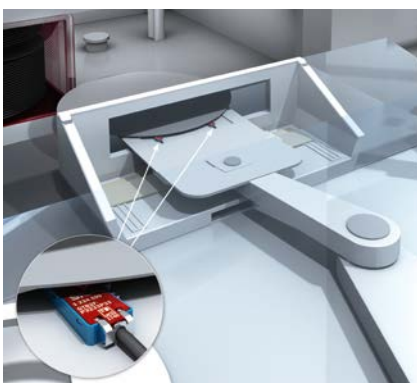
Presence and position monitoring on the wafer robot

Two G2F photoelectric sensors on the wafer robot check for the presence and correct position of wafers. The very high detection accuracy of the photoelectric sensors for reflective, transparent and shiny object surfaces enable them to reliably detect the wafer. The miniature housing of the G2F makes it especially suitable for integration into the narrow grippers of the wafer robot.

➜ www.sick.com/G2F
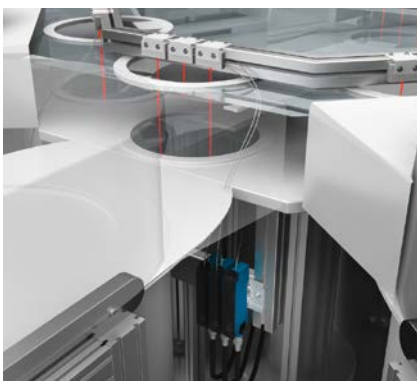
Quick and accurate wafer detection

It is possible to optimize the positioning of the wafer in the robot gripper relative to its coordinates by using several sensors to manage the robot controller. To do this, sensors with the highest possible switching frequency, low jitter and a precise light spot are required. The WLL180T fiber-opticsensor, with a response time of just 16 μs in combination with LL3-TH fiber optics and low-size optics, is ultra-precise, cost-effective, and perfectly tailored to the requirements of the machine.

➜ www.sick.com/WLL180T
➜ www.sick.com/LL3-TH

FOUP conveyor systems positioning

It is essential for the position of FOUP conveyor systems to be pinpointed throughout the entire production process. With a resolution of 0.5 mm across its entire length, which can be up to 10 km, the optical linear measurement sensor OLM100 is an ideal solution to achieve this. The sensor is highly reliable with its four redundant sender LEDs, and this reliability ensures a long mean time between failures (MTBF).

➜ www.sick.com/OLM100

PROTECTING

Monitoring the route on electrical overhead conveyors

Thanks to the TiM3xx 2D laser scanner, FOUP conveyor systems are prevented from colliding with each other on electrical overhead conveyors. The TiM3xx does not require a connection to an external computer system to do this. Instead, preprogrammed fields are activated along the predetermined route. The automation is more efficient as a result of this, since more vehicles can work in the same space.
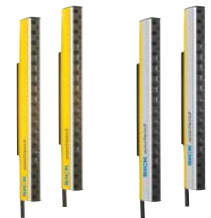
➜ www.sick.com/TiM-S
➜ www.sick.com/TiM3xx

Safety increasing productivity

Bond machines work at high speed, but idle time is often inevitable when machine operators are carrying out the unavoidable tasks of loading and unloading. The miniTwin safety light curtain has zero blind zones, so its L-shaped protection field is easy to install, granting the user fast and straightforward access to the loading and unloading area. The miniTwin thus reduces the processing time taken and yet still offers the best possible level of safety to the user.
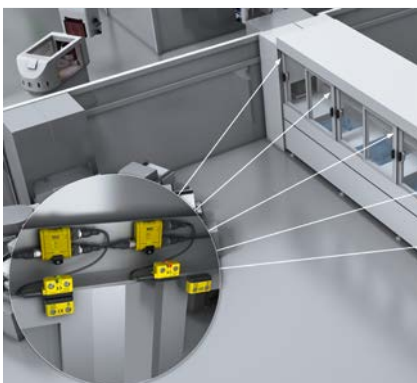
➜ www.sick.com/miniTwin

Intelligent and non-contact door protection

Process machines for the production of semiconductor wafers have many access doors. The STR1 safety switch and the Flexi Compact safety controller monitor these access doors. Solenoid interlocks are used to lock safety guards.

➜ www.sick.com/STR1
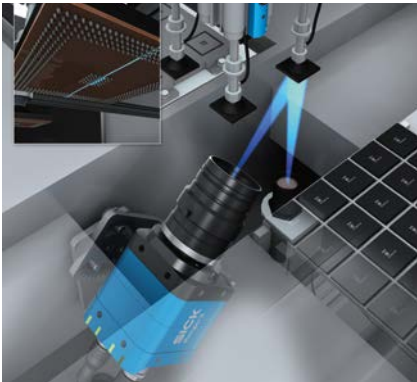➜ www.sick.com/FlexiCompact

Door monitoring with safe series connection

The Flexi Loop safe series connection makes wiring particularly simple and efficient. The individual monitoring of the sensors with detailed diagnostics also leads to fast problem solving.

➜ www.sick.com/FlexiLoop

MONITORING, INSPECTING AND IDENTIFYING

3D inspection and surveying of semiconductor chip connections

Before dispatching finished semiconductor chips, it is necessary to perform a demanding burn-in test at final inspection. This involves testing both the functionality and mechanical integrity of the semiconductor chips as well as the quality of the contact points and their coplanarity in ball grid arrays (BGAs). The Ranger3 3D vision system performs this inspection by generating up to 46,000 3D profiles per second and with the necessary precision demanded by the industry.


➜ www.sick.com/Ranger3
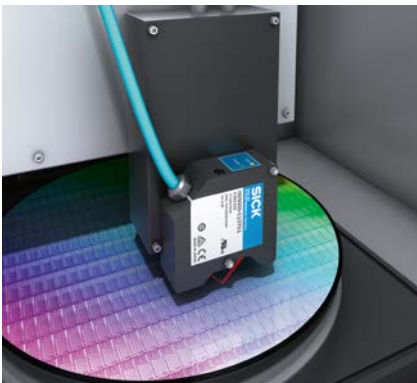
Height measurement for focus adjustment

High-precision inspection and laser systems in semiconductor or display production require lens systems with very precise focusing. The OD5000 displacement measurement sensor can measure a height profile of the lead frame with precision down to the last micrometer with up to 80,000 measurements per second. This data makes it possible to control the focus position and therefore achieve optimal process results.

➜ www.sick.com/OD5000
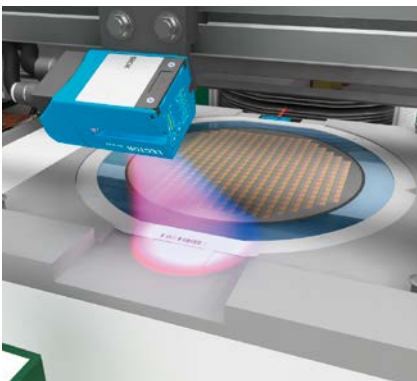
Identification of wafer carriers

The Lector61x or Lector62x camera-based code readers identify the wafer via the 1D or 2D codes attached to the wafer carrier. Integrated aiming laser, auto-focus, auto-setup, and green feedback LED make the code readers very user-friendly.

➜ www.sick.com/Lector62x
➜ www.sick.com/Lector61x

Notch recognition on semiconductor wafers

Accurately aligning the substrate is important when processing wafers. 2D vision sensors of the InspectorP6xx product families precisely detect the notch position of wafers and ensure their correct alignment. At the same time, the diffuser attachment eliminates disruptive wafer reflections. Using the Label Checker quality control system, it is also possible to scan the codes and text applied to the wafers.
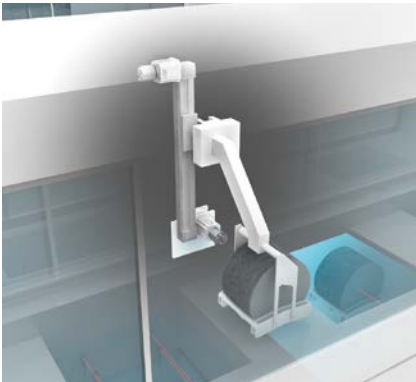

➜ www.sick.com/LabelChecker
➜ www.sick.com/InspectorP61x
➜ www.sick.com/InspectorP62x

HARSH AMBIENT CONDITIONS

Monitoring the positions of wafer carriers

The position of the wafer carrier can be determined reliably with absolute encoders: with the AFS60 Singleturn on the vertical and the AFM60 Multiturn on the horizontal axis. Thanks to the fieldbus and Industrial Ethernet interface, it is possible to integrate the encoders into the machine controller easily and cost-effectively and they can be used even under extreme ambient conditions such as high temperatures.

➔ www.sick.com/AFS/AFM60
➔ www.sick.com/A3M60

Corrosive chemical level measurement

Measuring the level of corrosive chemicals poses a real challenge for sensors. Failures must be avoided at all costs. The PTFE-sheathed UP56 Pure ultrasonic level sensor is rugged and durable. It has industry-standard analog and digital outputs, which makes it easy to integrate.

➔ www.sick.com/UP56Pure
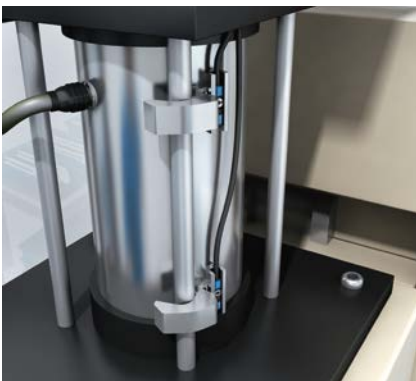
Monitoring of cylinder position at high temperatures

MZT8 magnetic cylinder sensors are perfectly suited to monitor the position of cylinders in process or handling machines. Thanks to their resistance to temperature up to 100 °C, they ensure reliable operation even under these extreme ambient conditions.

➔ www.sick.com/MZT8

Reliable optical detection in vacuum environments

Fiber-optic sensors from SICK can detect substrates in vacuum environments. Special fibers can be used directly in the vacuum chamber. The special bus-compatible variant can ensure from the outside that several sensors pointing into the chamber through inspection glasses do not interfere with one another.

➔ www.sick.com/WLL180T

SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With more than 10,400 employees and over 50 subsidiaries and equity investments as well as numerous agencies worldwide, SICK is always close to its customers. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents, and preventing damage to the environment.

SICK has extensive experience in various industries and understands their processes and requirements. With intelligent sensors, SICK delivers exactly what the customers need. In application centers in Europe, Asia, and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes SICK a reliable supplier and development partner.

Comprehensive services round out the offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

That is "Sensor Intelligence."

Worldwide presence:

Australia, Austria, Belgium, Brazil, Canada, Chile, China, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Hong Kong, India, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, Romania, Russia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, USA, Vietnam.

Detailed addresses and further locations ➜ **www.sick.com**

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