

Magnetic Sensors

TDK unveils new high-performance, cost-effective Hall-effect 2D position sensor family for automotive applications

- HAL/HAR 35xy* is an ASIL C ready, stray-field robust Hall-effect 2D position sensor family with enhanced features for safety-critical automotive applications
- New sensors include a single-die version (HAL 3550) and a dual-die version (HAR 3550) with analog (linear, ratiometric) and digital (PWM, SENT & Switch) output interfaces
- Based on the flagship Micronas HAL/HAR 39xy family, offering a more cost-effective option without sacrificing performance or functional safety performance
- Main target applications are steering wheel angles, brake and accelerator pedal positions, valve positions, and chassis position detection**

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TDK Corporation (TSE:6762) introduces the stray-field robust Micronas HAL/HAR 35xy* 2D Hall-effect position sensor family for automotive and industrial applications. Building on the success of the HAL/HAR 39xy series, the new sensors offer enhanced features and capabilities to meet the growing demand for stray-field robust 2D position detection in linear and angular applications. While the HAL/HAR 39xy family focuses on high flexibility, diverse features and interfaces, and superior performance, HAL/HAR 35xy is designed for mainstream applications that demand a core feature set with reduced flexibility, while maintaining high standards in functional safety and performance. With versatile programming, high accuracy, and ISO 26262 compliance, the HAL/HAR 35xy is a potential solution for safety-critical automotive applications, including accelerator pedals, brake pedal position or brake stroke sensors, steering angle detection, valve position such as throttle, shift position, non-contact potentiometers, transmission position detection, and chassis height measurement.** Start of production is planned for June 2025. Samples are already available.

The first sensors in the new family comprise the HAL 3550, a single-die version, and the HAR 3550, a dual-die version that provides full redundancy with two independent dies housed in a single package. The new sensor family is designed to cater to the stringent functional safety requirements of ISO 26262 compliant development. HAL 3550 and HAR 3550 are defined as safety element out of context (SEooC) and are ASIL C ready, making them suitable for integration into automotive safety-related systems up to ASIL D.

HAL 3550 and HAR 3550 are high-resolution position sensors engineered for precise position measurements, featuring a linear, ratiometric analog output with passive wire-break detection, as well as configurable PWM or SENT outputs. The SENT mode supports messages with or without pause pulse, adhering to SAE J2716 rev. 4 standards, with customizable parameters such as tick time and frame format. The PWM output offers flexibility with frequencies ranging from 0.1 kHz to 2 kHz. In addition, HAL/HAR 3550 offers a switch output (open-drain), derived from calculated position information or other sources along the signal path, such as temperature or magnetic-field amplitude. Users can define on/off switching points, switch logic, and polarity to suit their specific application needs.

Capable of measuring a full 360° angular range and linear movements of a magnet, the sensors are particularly suited for chassis position sensor applications, featuring a modulo function that allows the 360° measurement range to be divided into sub-segments of 90°, 120°, or 180°.

Utilizing Hall technology, the HAL/HAR 3550 measures vertical and horizontal magnetic-field components and effectively suppresses external magnetic stray fields with an array of Hall plates. A simple, low-cost two-pole ferrite magnet is sufficient for rotation angle measurements, ideally positioned in an end-of-shaft configuration. The sensors also support stray-field robust off-axis measurements.

On-chip signal processing capabilities allow the calculation of one angle per die from the magnetic-field components. This information is then converted into an analog or digital output signal. Key characteristics such as gain, offset, and reference position can be tailored to the magnetic circuitry via programmable non-volatile memory.

Designed for both automotive and industrial applications, the sensors operate within an ambient temperature range of $-40\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$. They are available in a SOIC8 SMD package for the single-die version and a TSSOP16 SMD package for the dual-die version.

Main applications**

- Accelerator pedals
- Brake pedal position / brake stroke sensor
- Steering angle
- Valve position, e.g. throttle
- Shift position
- Non-contact potentiometer
- Transmission position detection
- Chassis height

Main features and benefits***

- Accurate angular measurement up to 360° and linear position detection
- Compensation of magnetic stray-fields
- SEooC ASIL C ready according to ISO 26262 to support Functional Safety applications
- Wide supply voltage range of 4 V up to 18 V
- Overvoltage and reverse-voltage protection
- Under- and overvoltage detection on VSUP
- Customer-configurable Analog (12-bit ratiometric), PWM or SENT output or additional switch output (open-drain) with customer-configurable switching levels
- Operates from $-40\text{ }^{\circ}\text{C}$ up to $150\text{ }^{\circ}\text{C}$ ambient temperature
- Programming via the sensor's output pin. No additional programming pin required
- Various configurable signal processing parameters, like output gain and offset, reference position, temperature dependent offset, etc.

Type	Package	Output formats	Angular error	Magnetic-field amplitude range	Safety
HAL 3550	SOIC8	Analog, SENT, PWM and Switch	$\pm 0.9^{\circ}$	10 mT ... 200 mT	ASIL C ready, developed according to ISO 26262:2018
HAR 3550	TSSOP16				

* HAL/HAR 39xy and HAL/HAR 35xy use licenses of Fraunhofer Institute for Integrated Circuits (IIS).

** Any mention of target applications for our products are made without a claim for fit for purpose as this has to be checked at system level.

*** All operating parameters must be validated for each customer application by customers' technical experts.

About TDK Corporation

TDK Corporation is a world leader in electronic solutions for the smart society based in Tokyo, Japan. Built on a foundation of material sciences mastery, TDK welcomes societal transformation by resolutely remaining at the forefront of technological evolution and deliberately “Attracting Tomorrow.” It was established in 1935 to commercialize ferrite, a key material in electronic and magnetic products. TDK’s comprehensive, innovation-driven portfolio features passive components such as ceramic, aluminum electrolytic and film capacitors, as well as magnetics, high-frequency, and piezo and protection devices. The product spectrum also includes sensors and sensor systems such as temperature and pressure, magnetic, and MEMS sensors. In addition, TDK provides power supplies and energy devices, magnetic heads and more. These products are marketed under the product brands TDK, EPCOS, InvenSense, Micronas, Tronics and TDK-Lambda. TDK focuses on demanding markets in automotive, industrial and consumer electronics, and information and communication technology. The company has a network of design and manufacturing locations and sales offices in Asia, Europe, and in North and South America. In fiscal 2024, TDK posted total sales of USD 14.6 billion and employed about 101,000 people worldwide.

About TDK-Micronas

TDK-Micronas is the center of competence for magnetic-field sensors and CMOS integration within the TDK Group. TDK-Micronas has gained operational excellence for sensors and actuators production in over 25 years of in-house manufacturing. It was the first company to integrate a Hall-effect based sensor into CMOS technology in 1993. Since then, TDK-Micronas has shipped over seven billion Hall sensors to the automotive and industrial market. The operational headquarters are located in Freiburg im Breisgau (Germany). Currently, TDK-Micronas employs around 1,000 people.

You can download this text and associated images from <https://www.micronas.tdk.com/en/tradenews/pr2501>.

Further information on the products can be found under <https://www.micronas.tdk.com/en/products/angle-sensors/hal-35xy>.

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