

Magnetic sensors

TDK introduces new stray-field robust 3D-magnetic position sensor with capabilities for processing external signals

- HAL/HAR 3936-4100 is a high-precision, stray-field robust Hall-effect 3D-position sensor with low-power functions
- The sensor offers the possibility to read-in external digital signals (PWM & Switch) that can be transmitted via SENT interface together with the magnetic position information
- Main target applications are stray-field robust steering column switches, shifter and alternative joystick-like setups

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TDK Corporation (TSE:6762) further extends its renowned Micronas 3D HAL®-position sensor family with the HAL/HAR 3936*, the newest addition to its distinguished Hall-effect-based 3D-position sensor portfolio. Developed with a focus on meeting the stringent requirements of modern automotive and industrial applications, the HAL/HAR 3936 represents a significant advancement in magnetic position processing technology. Thanks to the sensor's versatile programming characteristics and its high accuracy, the HAL/HAR 3936 is a potential solution for steering column switches, gear selectors, brake pedal position sensors, or brake stroke sensors.** Samples are already available. Start of production is planned for the end of 2024.

Designed to address the industry's demand for robust 3D position sensors and compliance with ISO 26262 standards, the HAL/HAR 3936 offers a reliable solution for various applications, including steering column switches. Noteworthy features include a power-saving low-power mode, facilitating direct connection to a vehicle's battery for improved efficiency. Furthermore, the sensor's integrated SENT interface enables seamless transmission of external digital signals, enhancing its versatility in diverse operational environments.

The HAL/HAR 3936 is available in a dual-die variant, the HAR 3936-4100, engineered to provide enhanced redundancy and reliability. Utilizing a stacked-die architecture, this variant ensures synchronous measurements of magnetic signals by occupying the same magnetic field position. As a result, it delivers high-resolution position measurements, meeting the stringent accuracy requirements of modern applications.

With customer-configurable PWM or SENT outputs, the HAL/HAR 3936 offers flexibility to adapt to various application needs. In SENT mode, the sensor adheres to SAE J2716 rev. 4 standards, with configurable parameters such as tick time and frame format. Additionally, the sensor features two functional modes - application mode and low-power mode - selectable via an input signal, enabling optimized power consumption based on operational requirements.

In application mode, the HAL/HAR 3936 excels in measuring a 360° angular range, linear movements, and stray-field robust 3D position information of a magnet. The stray-field robust 3D modes, together with the possibility to read external signals, enable a new robustness of steering column switch detection that was never available before. Leveraging Hall technology, the sensor effectively suppresses external magnetic stray fields, ensuring accurate measurements in any scenario.

The HAL/HAR 3936 complies with SEooC (Safety Element out of Context) ASIL C standards according to ISO 26262:2018, ensuring compatibility with automotive safety requirements up to ASIL D. Designed for operation

in harsh environments, the sensor operates flawlessly within an ambient temperature range from $-40\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$, making it suitable for automotive and industrial applications.

Available in a SOIC8 SMD package as a single-die device and in a SSOP16 SMD package for the dual-die version, the HAL/HAR 3936 offers a reliable and versatile solution for demanding 3D position sensing applications.

Glossary

- Stray-field compensation: Modern Hall-effect sensors must be insensitive against disturbing fields generated by e-motors or power lines in hybrid or electric vehicles (xHEV)

Main applications**

- Steering column switches
- Gear selectors
- Brake pedal position sensor
- Brake stroke sensor

Main features and benefits

- Stray-field robust 3D position detection, 360° rotary and linear position detection up to 35 mm
- Capturing of external digital signals (like PWM and switch) and transmission of those signals via SENT
- Calculation of two angles and transmission on two separate output pins as PWM signals
- Support of various SENT frame formats, like H1.A7, F1.1, F1.2 and F2.4
- High robustness against mechanical misalignment between sensor and magnet in rotary setups
- Optimized design supporting rotary setups together with ferrite magnets
- SEooC ASIL C ready according to ISO 26262:2018 to support Functional Safety applications (The device can be integrated into automotive safety-related systems up to ASIL D)
- PWM and SENT output
- Additional switch output (open-drain)
- Suitable for automotive applications, due to a wide ambient temperature range from $-40\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$

Type	Package	Output formats	Angular error	Magnetic-field amplitude range	Safety
HAL 3936-4100	SOIC8	SENT, PWM and Switch	$\pm 0.6^{\circ}$ @ 10 mT for rotary measurements	From 10 mT up to max. 200 mT (depending on measurement mode)	ASIL C ready, developed according to ISO 26262:2018
HAR 3936-4100	SSOP16				

* HAL/HAR 39xy uses 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 six 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/pr2403>

Further information on the products can be found <https://www.micronas.tdk.com/en/products/direct-angle-sensors/hal-39xy>

Contacts for regional media

Region	Contact		Phone	Mail
Global	Ms. J. ANDRIS	TDK-Micronas GmbH, Freiburg, Germany	+49 761 517 2531	mic-media@tdk.com