

Magnetic Sensors

TDK releases new stray-field robust 3D HAL® position sensor with SPC interface

- 3D position sensor with SPC interface based on the Hall-effect allows active stray-field compensation
- 360 degrees, stray-field robust angular measurement makes this sensor suitable for steering-angle position detection*

September 30, 2020

TDK Corporation (TSE:6762) announces the portfolio expansion of the Micronas masterHAL® sensor family with the release of HAL 3970, a new stray-field robust 3D HAL® position sensor. The sensor, suited for automotive and industrial applications, has highly accurate angular detection from 0° to 360°, linear position detection, and uses Short PWM Code frames (SPC) to transmit the calculated position information. SPC is an enhancement of the standard SENT protocol according to SAE J2716. It enables data to be transmitted based on a trigger pulse sent by an external ECU, and it supports point-to-point connections as well as a single-wire bus mode with up to four sensors. Parameters such as unit time, frame format, trigger mode, slow channel format, rolling counter, and more, are easily configurable. For example, HAL 3970 can be used for stray-field robust angle detection in steering-wheel position applications*. Samples will be available in the fourth quarter of 2020.

Each sensor within the HAL 39xy sensor family is based on the patented 3D HAL pixel cell technology**. HAL 3970 uses a special array of Hall plates for high-accuracy measurement of vertical and horizontal magnetic-field components. Due to the sophisticated arrangement of these Hall plates, the sensor detects angles up to 360 degrees and suppresses external magnetic stray fields. Only a simple two-pole magnet is required to determine rotation angle. Ideally, the magnet should be placed above the sensitive area in an end-of-shaft configuration. The sensor also supports stray-field robust off-axis measurements.

The on-chip signal processing of HAL 3970 calculates the angle out of the magnetic-field components and converts this value into a digital output value. The sensor features a powerful DSP and an embedded microcontroller. The DSP is responsible for fast signal processing, while the microcontroller performs the interface configuration and supervision of the functional safety-related tasks.

Primary characteristics like gain and offset, reference position, etc. can be adjusted to the magnetic circuitry by programming the non-volatile memory. HAL 3970 is defined as SEooC (Safety Element out of Context) ASIL B-ready, according to ISO 26262. HAL 3970 is available in the eight-pin SOIC8 SMD package.

* 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.

** HAL 39xy uses licenses of Fraunhofer Institute for Integrated Circuits (IIS)

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

Glossary

- 3D HAL® pixel cell: Enables the direct measurement of magnetic fields in three directions X, Y, Z.
- Stray-field compensation: Modern Hall-effect sensors must be insensitive against disturbing fields generated by e-motors or power lines in hybrid (xHEV) or electrical vehicles (xEV).

Main applications*

- Steering-angle detection
- Long-stroke measurements in transmission systems or clutch applications

Main features and benefits***

- Stray-field robust position detection (linear and rotary up to 360°) covering ISO 11452-8 requirements
- Compensation of stray fields with gradients for applications with 180° rotation
- Transmission of position and temperature information including rolling counter
- Supports SPC-enhanced 12-bit serial message format including temperature information
- Various SPC trigger modes (constant/variable length and short trigger pulse (point-2-point))
- Programming via sensor's output pin at minimum supply voltage
- SEooC ASIL B-ready according to ISO 26262 to support functional safety applications
- Wide supply voltage range: 3.0 V to 16 V
- Up to 16 kSps sampling frequency
- Suitable for automotive applications due to a wide ambient temperature range from -40 °C up to 150 °C

Key data

Type	HAL 3970
Package	SOIC8
Digital output format	SPC
Angular error	±0.6°
Magnetic field amplitude range	±10 mT... ±130 mT
Safety	ASIL B-ready
Sample availability	Q4/2020

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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 2020, TDK posted total sales of USD 12.5 billion and employed about 107,000 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 has been the first company to integrate a Hall-effect based sensor into CMOS technology in 1993. Since then, TDK-Micronas has shipped over five 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.

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<https://www.micronas.tdk.com/en/tradenews/pr2003>.

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

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