

 Press Information

Magnetic Sensors

TDK introduces new dual-die, stray-field robust motor position sensor for ASIL D fail operational applications

- Full redundancy through two independent dies stacked in a compact QFN24 4×4 mm² package
- ASIL D ready as a Safety Element out of Context (SEooC), with integrated diagnostics and independent fault detection for each die
- Stray-field compensation per ISO 11452-8:2015 via an array of six horizontal Hall plates per die
- High-speed analog sine/cosine outputs with low jitter for precise motor control

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TDK Corporation (TSE:6762) introduces the Micronas HAR 3025, a dual-die stray-field robust motor position sensor with analog sine/cosine output, designed for automotive and industrial safety-critical applications. The HAR 3025 extends TDK's fast angular position sensor family with a fully redundant architecture housed in a single compact package, specifically addressing electric power steering systems, x-by-wire motor control applications, including steer-by-wire actuators, brake-by-wire motors, and high-voltage traction motor commutation.* Defined as a Safety Element out of Context (SEooC) ASIL D ready according to ISO 26262:2018, the device is designed to meet the highest automotive functional safety requirements. Samples of the HAR 3025 are available now. Start of production is planned for the first half of 2027.

The HAR 3025 provides full redundancy through two independent dies stacked within a single compact 4×4 mm² QFN24 package. The stacked-die architecture with coinciding die alignment ensures that both dies occupy the same magnetic field, generating synchronous position signals and thereby enabling plausibility comparison on system level. Each die uses an array of six Hall plates and internal signal processing to suppress external magnetic stray fields in accordance with ISO 11452-8:2015. This enables reliable angular measurement without magnetic shielding or strong target magnets.

The HAR 3025 is defined as SEooC ASIL D ready according to ISO 26262:2018, with each die fulfilling ASIL D metrics. Both dies are independent to each other. If one die fails, the second die of HAR 3025 remains fully operational and ASIL D compliant. An essential capability for safety-critical functions such as steer-by-wire motor position sensing. Integrated diagnostics monitor key internal and external functions, including supply voltage, clock, temperature, Hall signal processing, EEPROM and configuration registers. When a fault is detected, the outputs of the affected die switch to high impedance, allowing the ECU to identify the fault using external pull-up or pull-down resistors.

The HAR 3025 provides redundant differential or single-ended sine and cosine analog outputs for external absolute angle calculation by the microcontroller or ECU. The configurable signal path supports programming of essential parameters — including sine/cosine gain, offset, 0-angle, orthogonality, and magnetic signal

bandwidth — via the sensor's output pin, eliminating the need for an additional programming pin and simplifying end-of-line calibration. Four selectable amplifier bandwidths from 4.6 kHz to 70.5 kHz allow designers to optimize the balance between delay time and angular noise.

The HAR 3025 operates across a supply voltage range of 3.0 V to 5.5 V and covers a junction temperature range of $-40\text{ }^{\circ}\text{C}$ to $170\text{ }^{\circ}\text{C}$, with a maximum ambient temperature of $150\text{ }^{\circ}\text{C}$. Total angular error with static end-of-line calibration is $\leq 0.6^{\circ}$, reducible to $\leq 0.1^{\circ}$ with dynamic external compensation, supporting precise motor control applications.

Glossary

- ASIL D ready: Indicates the device is developed according to ISO 26262 to be integrated into systems requiring the highest Automotive Safety Integrity Level.
- SEooC: Safety Element out of Context
- Stray-field compensation: Modern Hall-effect sensors must be insensitive against disturbing magnetic fields generated by e-motors or power lines in hybrid and electric vehicles (xEV). HAR 3025 achieves this compensation internally through its Hall plate array architecture, without external shielding.

Main applications*

- Rotary position measurement for commutation of:
 - Brushless DC motors (BLDC)
 - Permanent magnet synchronous motors (PMSM)
 - AC induction motors (ACIM)
- Steer-by-wire systems:
 - Steering rack actuators
 - Steering wheel actuators
- Electric power steering motors
- Steering wheel angle position
- Brake-by-wire systems:
 - Electrohydraulic braking motors
 - Electromechanical braking motors
- HV traction motors

Main features and benefits**

- Full redundancy in a single package through two independent stacked dies with coinciding centers of sensitivity, supporting fail-operational architectures without the added footprint of multi-package solutions
- Stray-field compensation per ISO 11452-8:2015, eliminating the need for magnetic shielding or oversized target magnets and giving designers greater freedom in motor layout
- SEooC ASIL D ready according to ISO 26262:2018, supporting integration into systems requiring the highest automotive functional safety integrity level
- Fail-operational support enabling continued system operation in the event of a single die fault
- High-speed 360° contactless angle measurement for motor commutation up to 60,000 rpm
- Comprehensive integrated on-chip diagnostics reducing the external supervision burden on the ECU
- EMC robust differential or single-ended sine/cosine analog outputs with passive wire-break detection and low jitter of delay time (RMS) of max. 2 ns
- Ratiometric analog outputs referenced to the supply voltage
- Configurable signal path parameters (sine/cosine gain, offset, 0-angle, orthogonality, bandwidth)
- Supply voltage range: 3.0 V to 5.5 V
- Junction temperature range: $-40\text{ }^{\circ}\text{C}$ to $170\text{ }^{\circ}\text{C}$
- Overvoltage and reverse-voltage protection
- Compact $4\times 4\text{ mm}^2$ QFN24 package with wettable flanks for lean automated optical inspection (AOI)

Type	Package	Output Formats	Angular error (over temperature and lifetime)	SIN/COS Delay Time	Safety
HAR 3025	QFN24 (4×4 mm)	Redundant Analog Sine/Cosine (differential or single-ended)	≤0.6° (with static compensation) ≤0.1° (with external dynamic compensation)	4.16 μs – 42.69 μs (configurable per bandwidth)	ASIL D ready

* Any mention of target applications for our products is 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 customer's technical experts.

About TDK Corporation

TDK Corporation (TSE:6762) is a global technology company and innovation leader in the electronics industry, based in Tokyo, Japan. With the tagline “In Everything, Better” TDK aims to realize a better future across all aspects of life, industry, and society. For over 90 years, TDK has shaped the world from within; from the pioneering ferrite cores to cassette tapes that defined an era, to powering the digital age with advanced components, sensors, and batteries, leading the way towards a more sustainable future. United by TDK Venture Spirit, a start-up mentality built on visions, courage and mutual trust, TDK's passionate team members around the globe pursue better—for ourselves, customers, partners, and the world. Today, the state-of-the-art technologies of TDK are in everything, from industrial applications, energy systems, electric vehicles, to smartphones and gaming, at the core of modern life. TDK's comprehensive, innovative-driven portfolio includes cutting-edge passive components, sensors and sensor systems, power supplies, lithium-ion and solid-state batteries, magnetic heads, AI and enterprise software solutions, and more—featuring numerous market-leading products. These are marketed under the product brands TDK, InvenSense, Micronas, Tronics, TDK-Lambda, TDK SenseEI, and ATL. Positioning the AI ecosystem as a key strategic area, TDK leverages its global network across the automotive, information and communication technology, and industrial equipment sectors to expand its business in a wide range of fields. In fiscal 2026, TDK posted total sales of USD 16.6 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 was the first company to integrate a Hall-effect based sensor into CMOS technology in 1993. Since then, TDK-Micronas has shipped over eight 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/pr2604>.

Further information on the products can be found under <https://www.micronas.tdk.com/en/products/angle-sensors/har-30xy>.

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