Magnetic Sensors

**TDK announces the ASIL-B upgrade of its 3D HAL® direct-angle sensor family HAL 37xy**

* 3D HAL© technology-based magnetic sensor family with analog and digital output format for functional safety applications
* HAL 37xy (single-die) and HAR 37xy (dual-die) in SOIC-8 SMD package
* HAC 37xy in a leaded TO92UF package with integrated capacitors

May 20, 2021

TDK Corporation (TSE:6762) has upgraded its Micronas 3D HAL® direct-angle Hall-effect sensor family, HAL 37xy (HAL 37xy, HAR 37xy and HAC 37xy)\*, for automotive and industrial applications regarding functional safety aspects. All members of HAL 37xy are now defined as SEooC (Safety Element out of Context) ASIL B-ready, according to ISO 26262. HAL 37xy rotary position detection features are used in applications such as accelerator pedals, electronic throttle controls, rotary shifters (with push-function) and rear-axis steering systems. Furthermore, the sensors detect linear position in applications like clutch or brake pedals, transmission systems, cylinders and valve position sensing.\*\* Relevant documentation, like safety manuals and FMEDA summary reports are available on request.

HAL 37xy family’s production is already ongoing; samples are available at any time.

TDK enabled vertical Hall plates to integrate into the standard CMOS process through its 3D HAL technology. The process made it easier to evaluate relative strength of the horizontal and vertical magnetic field components, which is key for excellent angular performance. In comparison, conventional planar Hall technology is only sensitive to the magnetic field orthogonal to the chip surface. TDK offers three different direct-angle sensor variants with the HAL 37xy sensors: the proven HAL 37xy sensor family, a version with redundancy function via two integrated Hall sensor dies (HAR 37xy), and a version with integrated capacitors (HAC 37xy).

The robust direct angle sensor family HAL 37xy offers outstanding temperature stability, high resistance against air gap variations and magnet aging, a range of diagnostic functions and very effective protection circuitry. HAR 37xy, the dual-die version of the HAL 37xy family, provides full redundancy from two independent dies stacked in a single package that are bonded on separate sides. The stacked-die architecture ensures that both dies occupy the same magnetic-field position, thus generating synchronous measurement outputs. Redundant sensor solutions in a single package reduce system costs while increasing the reliability of the system through smaller PCBs and less solder joints. HAC 37xy integrates a chip from the HAL 37xy sensor family and two capacitors up to 330 nF in a three-lead TO package for an ESD immunity of up to 8 kV. The pins of the package can be welded or soldered directly to a lead frame eliminating the need for a printed circuit board (PCB) and reducing the total system size and cost.

The ASIL-B upgrade enables the TDK sensor customers’ base to use this product family in applications with functional safety demands. It makes the HAL 37xy mature product line fit for future customer applications.

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**Glossary**

* 3D HAL® pixel cell: Enables the direct measurement of magnetic fields in three directions X, Y, Z.
* Safety Manual: Describes how to correctly use the devices in functional safety applications
* FMEDA: Failure Modes, Effects and Diagnostic Analysis

**Main applications\*\***

* Detection of angle of rotation automotive applications, such as accelerator pedal, electronic throttle control, rotary shifters (with push-function), as well as rear-axis steering systems
* Detection of linear position in applications like clutch or brake pedal, transmission system, cylinder and valve position sensing

**Main features and benefits\*\*\***

* Very low angular error of ±1.5° @ 30 mT amplitude
* End of shaft and off-axis 360° angular measurement
* Direct measurement of magnetic field amplitude (BX, BY, BZ)
* Family members with analog, PWM or SENT output
* SEooC according to ISO 26262 (ASIL-B ready) to support functional safety applications
* Suitable for automotive applications, thanks to a wide ambient temperature range from -40 °C up to max. 160 °C

**Key data**

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| Types | HAL 37xy, HAR 37xy, HAC 37xy |
| Packages | SOIC-8 and TO-92UF |
| Output formats | Analog, PWM, SENT SAE J 2716 |
| Accuracy | ±1.5° @ 30 mT |
| Flux density amplitude range | 20 mT… 100 mT. Down to 10 mT with reduced accuracy |
| Functional Safety | ISO 26262 ASIL-B ready |

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| \* | HAL 37xy uses licenses of Fraunhofer Institute for Integrated Circuits (IlS) |
| \*\* | 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. |

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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 2021, TDK posted total sales of USD 13.3 billion and employed about 129,000 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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You can download this text and associated images from <https://www.micronas.tdk.com/en/tradenews/pr2103>.

Further information on the products can be found under <https://www.micronas.tdk.com/en/products/direct-angle-sensors/hal-37xy>.

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