

## Magnetic Sensors

### **Redundant 3D HAL® technology based magnetic sensor with outstanding output flexibility**

- New Dual-Die Hall effect sensors HAR 379x with PWM output and SENT protocol according to SAEJ2716 rev. 4
- Superior angular measurement and redundancy functions for safety critical automotive and industrial applications in small SOIC8 package
- Presentation of HAR 379x sensors from June 26 to 28, 2018, at the Sensor+Test exhibition in Nuremberg, Germany, at booth 204 in hall 1

June 7, 2018

TDK Corporation (TSE 6762) expands its Micronas Dual-Die Hall-effect sensor portfolio with the HAR 379x sensors for multidimensional magnetic field measurements in safety-critical automotive applications according to ISO 26262 rules and in industrial applications. The new sensors come with a digital output: besides pulse-width modulation (PWM) output, the SENT protocol according to the latest generation of SAEJ2716 (rev. 4) is also supported. HAR 379x is the Dual-Die SMD package version of the HAC 37xy family using the proprietary Micronas 3D HAL® technology for detecting angles in a range between 0° and 360° (end-of-shaft and through-shaft setup) as well as linear movement or position. Samples will be available from July 2018. Start of production is planned for the first quarter of 2019.

TDK will present its HAR 379x sensors from June 26 to 28, 2018, at the Sensor+Test exhibition in Nuremberg, Germany, at booth 204 in hall 1.

The HAR 379x sensors' versatile programming characteristics and its high accuracy make the HAR 379x the perfect system solution for gear selector applications – especially because of the possibility to provide the magnetic field amplitude in combination with the angle information. Both parameters are made available via the fast channel of the SENT interface. Additionally, the magnetic field amplitude information enables the required push-functionality. The device fits perfectly into applications where linear movements have to be measured, e.g. in dual-clutch transmission applications, for clutch pedal position detection, as engine stroke sensor, for transmission position measurement, or for cylinder and valve position sensing.

Each HAR 379x sensor contains two dies operating fully independently. The two dies are placed upon each other in a way that they are still mechanically separated and electrically insulated from one another. Both sensitive elements are very close to each other thanks to the selected advanced assembly technology. The advantage is that the two Hall elements measure almost the same magnetic field, therefore ensuring synchronous output signals. Redundant sensor solutions in a single package reduce system costs while at the same time increasing the reliability of the system due to smaller PCBs and less solder joints. The HAR 379x is available in a very small eight-pin SOIC8 package.

Conventional planar Hall technology is only sensitive to the magnetic field orthogonal to the chip surface. By developing its 3D HAL<sup>®</sup> technology, Micronas enabled the integration of vertical Hall plates into the standard CMOS process. Thus, evaluating the relative strength out of the horizontal and vertical magnetic field components became feasible – the key for excellent angular performance. HAR 379x are dual-die integrated circuits with full redundant signals. Each sensor includes a so-called pixel cell, consisting of two vertical (BX, BY) and one horizontal (BZ) Hall plate with spinning current offset compensation for detection of X, Y or Z magnetic field components at one point. Magnetic field lines in parallel to the sensor surface are detected by the vertical Hall elements, whereas the component perpendicular to the chip surface is captured by the horizontal Hall element. HAR 379x sensors allow temperature-stable position measurements with high accuracy at reduced system cost. Furthermore, each sensor includes a signal processor for calculation and signal conditioning of two magnetic field components, protection devices, PWM and SAEJ2716 SENT output.

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## Glossary

- 3D HAL<sup>®</sup> technology: Enables the measurement of the magnetic field in all three directions X,Y,Z at one single spot (so-called pixel cell)

## Main applications

- Angle detection of rotation automotive applications, such as rotary shifters (with push-function), as well as rear-axis steering systems
- Detection of linear positions in applications like clutch or brake pedal, transmission system, cylinder and valve position sensing

## Main features and benefits

- Very low angular error of  $\pm 1.2^\circ$  @ 30 mT amplitude
- End of shaft and off-axis 360° angular measurement
- Direct measurement of magnetic field amplitude (BX, BY, BZ)
- Transmission of angle and amplitude information via fast channel of SENT
- Digital output formats (PWM and SENT SAE J2716 rev. 2016)
- Addresses safety-critical applications according to ISO 26262 rules
- Full redundancy due to Dual-Die approach
- Suitable for automotive applications, thanks to a wide ambient temperature range from -40 °C to 150 °C

## Key data

Type	HAR 3795, HAR 3796, HAR 3797
Package	SOIC8
Digital output formats	PWM (200 Hz ... 2 kHz), SENT SAE J2716 rev. 2016
Angular error	$\pm 1.2^\circ$ @ 30 mT
Magnetic field measurement range	20 mT ... 100 mT. Down to 5 mT with reduced accuracy.
Safety	Full redundant solution. SPFM $\geq 90\%$ , LFM $\geq 60\%$
Sample availability	July 2018

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## About TDK-Micronas

TDK-Micronas, a TDK group company, is the most preferred partner for sensing and control. TDK-Micronas serves all major automotive electronics customers worldwide, many of them in long-term partnerships for lasting success. Operational headquarters are based in Freiburg im Breisgau (Germany). Currently, TDK-Micronas employs around 900 persons. For more information about TDK-Micronas and its products, please visit [www.micronas.com](http://www.micronas.com).

## About TDK Corporation

TDK Corporation is a leading electronics company based in Tokyo, Japan. It was established in 1935 to commercialize ferrite, a key material in electronic and magnetic products. TDK's comprehensive 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 the areas of information and communication technology and automotive, industrial and consumer electronics. The company has a network of design and manufacturing locations and sales offices in Asia, Europe, and in North and South America. In fiscal 2018, TDK posted total sales of USD 12 billion and employed about 103,000 people worldwide.

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