

Magnetic Sensors

TDK brings redundancy to its TMR angle sensor portfolio and aligns with ASIL D safety standard

- TAD4140 is a new, fully redundant TMR angle sensor with digital output in a TSSOP16 package for automotive and industrial applications
- The new sensor is able to simultaneously measure speed, direction, and motor position
- High-angular accuracy, high-diagnostic coverage, and advanced compensation algorithms make sensor suitable for BLDC motor commutation applications
- Full-signal redundancy with two electrically-isolated outputs that supports ASIL D system requirements

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TDK Corporation (TSE:6762) has announced the expansion of its tunnel-magnetoresistance (TMR) angle sensor portfolio with the new digital TAD4140 sensor. Designed for demanding automotive and industrial applications, compared to TDK's existing digital angle sensor - the TAD2141 - the new TAD4140 features full redundancy with two signal processor units and 2x2 TMR bridges in a single TSSOP16 package. Both angle sensors are capable of contactless sensing up to 360 degrees within an ambient temperature range of -40 °C up to +150 °C, making the device suitable for motor-control applications such as Brushless DC (BLDC) motor commutation in electric power assisted steering (EPAS) systems.

The various internal diagnostic features of TDK's digital angle sensor portfolio make both the TAD2141 and TAD4140 compatible with stringent automotive applications where functional safety is required, with the TAD4140 meeting the requirements of Automotive Safety Integrity Level D (ASIL D) ^{*1}, and able to support fail-safe applications due to its electrically-isolated signals, high signal availability, and high-diagnostic coverage.

Digital outputs support functionality such as Hall emulation (UVW), encoder up to 12 bits (ENC), incremental encoder (ABZ), pulse width modulation (PWM), and Serial Peripheral Interface (SPI). Due to its built-in redundancy, the TAD4140 can simultaneously give two different outputs such as ABZ and ENC to calculate speed, direction, and motor position. This means the sensor can be employed in applications with two electronic control units (ECUs) working in a master/slave configuration, for example in applications like steering motor position detection.

TDK's state-of-the-art TMR technology can be used in combination with a dedicated application-specific integrated circuit (ASIC) including an embedded digital signal processor (DSP). With integrated static and dynamic calibration functions, both the TAD2141 and TAD4140 can compensate for drifts in gain, offset, or orthogonality. The sensors guarantee an angle accuracy of ± 0.35 degrees, achieving the industry's highest accuracy for angle error of only ± 0.05 degrees at room temperature. Mechanical non-idealities including magnet tilting or magnet displacement can also be compensated for, allowing wider assembly tolerances for the mechanical components.

Both sensors are molded in a TSSOP16 package with identical pinout on one side of the package, giving customers design flexibility and simple switching to the redundant version (TAD4140) if required.

Samples of the TAD4140 are available now. Start of production is planned for the fourth quarter of 2020.

*1 : In the system configuration that TDK assumes

Glossary

- TMR: Tunnel Magneto-Resistance. Of all magnetic field sensors, TMR offers the greatest sensitivity.
- ASIC: An Application-Specific Integrated Circuit is an IC customized for a specific use.

Main applications

- BLDC motor position in various industrial applications, e.g. robot arms
- In automotive applications, e.g.
 - power steering motor commutation,
 - wiper actuator, or
 - clutch / e-clutch

Main features and benefits

- World's smallest angle error of just $\pm 0.05^\circ$
- Angle accuracy of $\pm 0.35^\circ$
- Digital output for all major interfaces, realized with an ASIC from ICsense
- Automatic angle error correction function and compensation to effect of mechanical misalignment
- Contactless 360° angle measurement
- Suitable for automotive applications due to a wide temperature range from -40°C to $+150^\circ\text{C}$

Key data

| TAD4140 | |
|--------------------------------|--|
| Package | TSSOP16 |
| Digital outputs | SPI, PWM, ENC, UVW |
| Angle accuracy | ± 0.35 degrees or less |
| Temperature range | -40°C up to $+150^\circ\text{C}$ (ambient) |
| Magnetic field measuring range | 20 to 80 mT (typical) 80 to 120 mT (extended range) |
| Safety | ASIL D*1 |
| Sample availability | Available |

*1 : In the system configuration that TDK assumes

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.

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https://www.tdk.com/corp/en/news_center/press/20200630_01.htm.

Further information on the products can be found under
https://product.tdk.com/info/en/documents/datasheet/tmr-angle/ds_sensor_tmr-angle_tad4140_en.pdf.

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