

HAL/HAR 3927

April/2024



HAL/HAR 3927 Programmable 2D Position Sensor with Analog Output and SENT Interface

The HAL/HAR 3927 is a new member of the 2D position sensor family using the proprietary 3D HAL[®] technology of TDK-Micronas, addressing the need for ISO 26262 compliant development. The device is a high-resolution position sensor for highly accurate position measurement. HAR 3927 is the dual-die version of HAL 3927. It provides full redundancy as it consists of two independent stacked dies in a very small eight-pin SOIC8 SMD package.

HAL/HAR 3927 features a linear, ratiometric analog output signal with integrated wire-break detection working with pull-up or pull-down resistors as well as a SAE J2716 compliant SENT output according to rev. 4. The SENT interface is customer configurable and supports various tick times between 1.5 μ s and 12 μ s as well as several frame formats, like secure sensor information, etc.

The sensor is able to measure horizontal and vertical magnetic-field components B_x , B_y , and B_z . On-chip signal processing calculates one angle out of two magnetic-field components and converts this value into an output signal. This enables a set of potential applications for position detection, such as wide distance, angle, or through-shaft angular measurements.

One key feature is the possibility to linearize the sensor's output characteristic for the customer's application with either 33 equidistant distributed setpoints or 17 variable setpoints.

This product is defined as SEooC (Safety Element out of Context) ASIL-B ready according to ISO 26262.

Major characteristics like gain and offset, reference position, etc. can be adjusted to the magnetic circuitry by programming the non-volatile memory.

The device is designed for operation in an ambient temperature range of $-40\text{ }^\circ\text{C}$ up to $150\text{ }^\circ\text{C}$.

The HAL/HAR 3927 sensor is available in a very small eight-pin SOIC8 package.

Features

- ◆ Accurate angular measurement up to 360° and linear position detection
- ◆ ASIL-B ready (SEooC according to ISO 26262)
- ◆ HAR 3927: Stacked-die architecture with full redundancy (dual-die)
- ◆ Operates from 4.5 V up to 5.5 V supply voltage
- ◆ Customer-selectable analog or SENT output
- ◆ 12 bit ratiometric linear analog output
- ◆ SENT according to SAE J 2716 rev. 4
- ◆ Configurable output slew rates
- ◆ Programmable arbitrary output characteristic with 17 variable or 33 equidistant distributed setpoints
- ◆ Support of three different SENT frames
 - H.1: Two 12 bit fast channels (position & temperature or magnetic amplitude)
 - H.2: 12 bit fast channel
 - H.4: 12 bit secure single sensor
- ◆ $T_A = -40\text{ }^\circ\text{C}$ up to $150\text{ }^\circ\text{C}$
- ◆ Programming via the sensor's output pin

HAL/HAR 3927

April/2024

Major Applications

HAL/HAR 3927 is a potential solution for the following application examples:

- ◆ Linear movement measurements in dual-clutch transmissions, engine stroke sensors, clutch pedal, as well as cylinder and valve position measurements
- ◆ Rotary position measurement in gear selectors, rotary selectors with push function, rear-axis steering, electronic throttle control, accelerator pedal, etc.

Development Tools

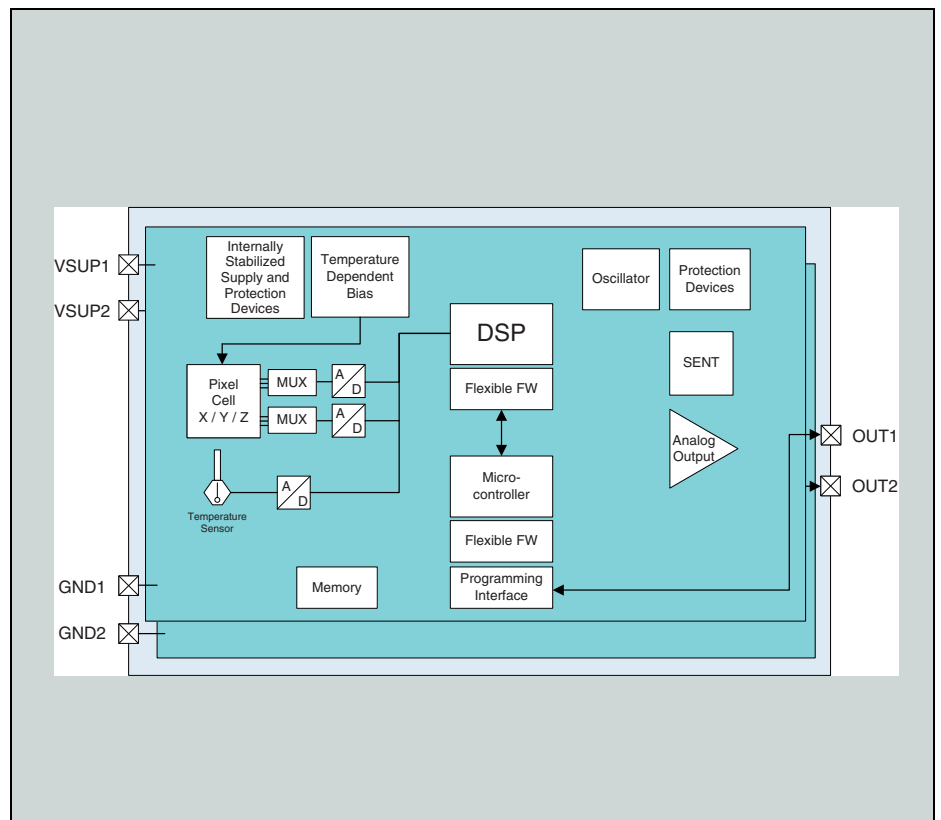
Each die can be programmed during the final manufacturing process by adjusting the output signals directly to the input signal. With this calibration procedure, the tolerances of the sensor, the magnet, and the mechanical positioning can be compensated in the final assembly.

TDK-Micronas offers an easy-to-use evaluation kit for engineering:

- ◆ Micronas programmer board (TDK-MSP V1.x)
- ◆ USB programming kit
- ◆ LabVIEW™ programming software for Windows® including Sub VIs

Available Types

Type	Output Format	Output Signals	Other Features
HAL/HAR 3927	Analog/Modulo	Ratiometric analog output voltage proportional to the position	<ul style="list-style-type: none"> ◆ Integrated wire-break detection working with pull-up or pull-down resistors ◆ Programmable interpolator for a smoother DAC analog output and reduced out-of-band noise
	SENT	According to SAE J 2716 rev. 4	<ul style="list-style-type: none"> ◆ Programmable tick time between 1.5 µs and 12 µs ◆ Transmission of OEM ID's via slow channel



License Note: HAL/HAR 3927 uses licenses of Fraunhofer Institute for Integrated Circuits IIS.

Fig. 1: Block diagram of the HAR 3927

All information and data contained in this product information are without any commitment, are not to be considered as an offer for conclusion of a contract, nor shall they be construed as to create any liability. Product or development sample availability and delivery are exclusively subject to our respective order confirmation form. By this publication, TDK-Micronas GmbH does not assume responsibility for patent infringements or other rights of third parties which may result from its use.

No part of this publication may be reproduced, photocopied, stored on a retrieval system, or transmitted without the express written consent of TDK-Micronas GmbH.

Edition April 11, 2024; Order No. PI000167_002EN