HAL 39xy, HAC 39xy, and HAR 39xy

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HAL 39xy, HAC 39xy, and HAR 39xy Stray-Field Robust 3D Position Sensors with Digital Output Interfaces

HAL 39xy is a new generation of 3D position sensors from TDK-Micronas addressing the need for stray-field robust position sensors (linear and angular) as well as the ISO 26262 compliant development.

This sensor family consists of various members. A detailed overview can be found on the back page.

All devices can measure a 360° angular range as well as linear movements. HAL/R 3900 and HAL/C/R 3930 support the option for 3D position detection. Depending on the device, it is possible to transmit temperature-compensated values of B_X, B_Y, B_Z or up to two calculated angles. The HAL 3980 is also capable of transmitting the angular speed.

All devices offer setpoint linearization with either 33 equidistant distributed setpoints or 17 variable setpoints.

The sensors measure the position of a magnet based on 3D HAL® technology from TDK-Micronas. The devices are able to suppress external magnetic stray fields by using an array of Hall plates. Only a simple two-pole magnet is required to measure a rotation angle. Off-axis measurements are also possible.

The sensors are 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 devices are designed for operation in an ambient temperature range of –40 °C up to 150 °C.

The HAL 39xy devices are available in a very small eight-pin SOIC8 package.

The HAC 39xy devices are available in a three-pin leaded TO92UF package. This package integrates up to two capacitors (max. 330 nF) together with the sensor chip.

With the integrated capacitors, HAC 39xy meets stringent ESD (system level) and EMC requirements and eliminates the need for a PCB, thus reducing the total system size and cost.

The HAR 39xy devices are available in a small sixteen-pin SSOP16 package with full redundancy. Each sensor contains two independent dies placed upon each other that are mechanically separated and electrically insulated. The two dies measure almost the same magnetic field, therefore ensuring synchronous output signals.

Features

- Accurate angular measurement up to 360° and linear position detection
- 3D position detection
- Robust against magnetic stray fields
- ASIL-B ready (SEooC according to ISO 26262)
- Wide supply voltage range: 3.0 V to 18 V
- Configurable output slew rates
- 0.1 kHz to 2 kHz PWM frequency
- Separate switch output (HAL 3930 / HAR 3930)
- SENT according to SAE J 2716 rev. 4
- 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
- SPC interface with ID selection mode, rolling counter, temperature information
- SPI interface (slave) with low-power modes
- PSI5 interface according to rev. 2.2
- 2-wire PWM interface
- T_A = –40 °C up to 150 °C

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Major Applications

HAL 39xy, HAC 39xy, and HAR 39xy are potential solutions for the following application examples:

◆ Chassis position

◆ Turbo-charger actuators

◆ Valve position detection

◆ EGR

◆ Shift position

◆ Steering angle

◆ Fuel-level measurements

◆ Clutch position

◆ Transmission position detection

◆ Brake stroke position sensors

◆ Accelerator pedal position detection

Development Tools

HAL 39xy, HAC 39xy, and HAR 39xy 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^{TM} programming software for Windows$^{®}$

◆ TDK SPI programmer for HAL 3900 / HAR 3900

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Available Types

| Type	Output Format	Output Signals	Other Features
HAL 3900 / HAR 3900	SPI	Up to two angles or values of B_X, B_Y, and B_Z	◆ Low-power mode with wake-up by magnetic field / position information change / wake-up pin ◆ 16-bit data with CRC and rolling counter ◆ 10 MHz SPI
HAL 3930 / HAC 3930 / HAR 3930	PWM/SENT/ Switch	Up to two angles	◆ Push-pull or open-drain output ◆ Programmable switching levels (HAL 3930 / HAC 3930 only)
HAL 3960 / HAC 3960	PWM	One angle	◆ 2-wire PWM
HAL 3970	SPC (Short PWM Code)	One angle and temperature	◆ Secure rolling counter ◆ Enhanced 12-bit serial message
HAL 3980 / HAC 3980	PSI5 rev. 2.2	One angle and angular speed	◆ PSI5 rev. 2.2 and support of frames of rev. 1.3 ◆ Asynchronous mode, synchronous parallel and universal bus mode, variable time-triggered bus mode
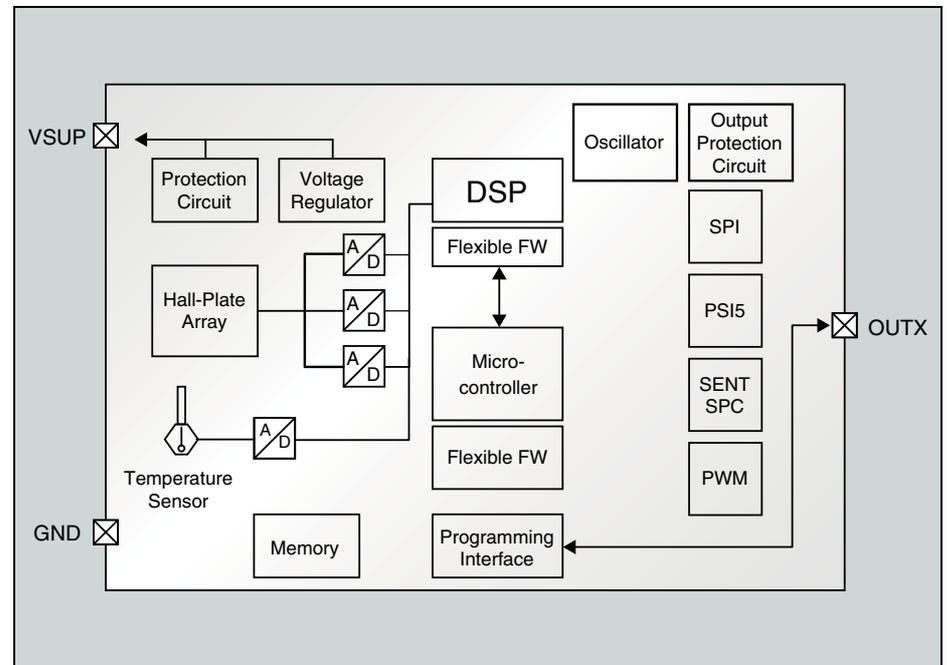
Fig. 1: Block diagram of the HAL 39xy