

# HAL 37xy

May/2014



## HAL<sup>®</sup> 37xy Second-Generation 3D HAL<sup>®</sup> Sensor Family with Superior Angular Accuracy

The HAL 37xy family is the second sensor generation using Micronas' proprietary 3D HAL technology, which offers a further improvement of the angular performance. Compared to the first generation, a 30% lower angular error has been achieved.

Operation with magnetic fields down to  $\pm 20$  mT is enabled thanks to the improved technology. HAL 3715 and HAL 372x provide a linear, ratiometric analog output signal with integrated wire-break detection working with pull-up or pull-down resistors. HAL 373x features digital output formats such as PWM and SENT SAEJ2716 rev. 2010. The digital output format is customer programmable.

The sensors can measure three magnetic field components  $B_x$ ,  $B_y$ , and  $B_z$ . This enables a set of potential applications for position detection, such as wide distance, angle or through-shaft angular measurements. On-chip signal processing calculates the angle out of two of the magnetic field components and converts this value into an output signal. The sensor exhibits excellent drift performance over the specified

temperature range resulting in a new class of accuracy for angular or linear measurements. The sensor features an arbitrarily programmable stepwise linear characteristic for linearization of the output signal. Major characteristics can be adjusted to the magnetic circuit by programming the non-volatile memory.

The sensors contain advanced on-board diagnostic features that enhance fail-safe detection. The devices are designed for automotive and industrial applications and operate in the junction temperature range from  $-40$  °C up to  $170$  °C. The sensors are available in a very small four-pin leaded transistor package TO92UP, as well as in a SOIC8 package.

### Features

- ◆ Measurement extremely robust against temperature and stress influences
- ◆ Operating with magnetic field amplitudes down to  $\pm 20$  mT with an angular accuracy of  $\pm 0.5\%$  FS (digital output, X-Y Hall plates)

- ◆ 12 bit ratiometric linear analog output for HAL 372x
- ◆ Modulo  $90^\circ/120^\circ$  output for HAL 3715
- ◆ 0.2 kHz to 2 kHz PWM (up to 12 bit) or 12 bit SENT output for HAL 373x
- ◆ Programmable arbitrary output characteristic with up to 33 setpoints
- ◆ Operates from  $V_{SUP}=4.5$  V up to 5.5 V
- ◆ Operates from  $T_J=-40$  °C up to  $170$  °C
- ◆ Programming via the sensor's output pin
- ◆ Programmable characteristics in EEPROM with redundancy and lock function
- ◆ 2<sup>nd</sup>-order temperature-dependent offset programmable for X/Y- or Z-channel
- ◆ On-chip diagnostics
- ◆ Short-circuit protected push-pull output
- ◆ Over-/reverse-voltage protection at  $V_{SUP}$
- ◆ Under- and overvoltage detection of  $V_{SUP}$
- ◆ Wire-break detection with pull-up and pull-down resistors

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## Major Applications

The new HAL 37xy family is the optimal system solution for applications, such as:

- ◆ Linear movement measurements (EGR, clutch, transmission position)
- ◆ Rotary position measurements (gear selector, motor air management)
- ◆ Non-contact potentiometer

## System Architecture

The sensors include two vertical and one horizontal Hall plate with spinning current offset compensation for the detection of X, Y, or Z magnetic field components, a signal processor for calculation and signal conditioning of two magnetic field components, protection devices, and a ratiometric linear analog, PWM, or SENT output.

The spinning current offset compensation minimizes the errors due to supply voltage and temperature variations or external package stress.

The signal path of HAL 37xy consists of two channels (CH1 and CH2). Depending on the product variant, two out of the three magnetic field components are connected to Channel 1 and Channel 2.

The sensors can be used for angle measurements in a range between 0° and 360° (end-of-shaft and through-shaft setup), as well as for robust position detection (linear movement or position). The in-system calibration can be utilized by the system designer to optimize the performance for a specific system. The calibration information is stored in the on-chip EEPROM.

The HAL 37xy is programmable by modulating the output voltage. No additional programming pin is needed.

## Available Types and Behavior

Type	Output Format	Detectable Field Component
HAL 3715	Analog Modulo	$B_x$ and $B_y$
HAL 3725	Analog	$B_x$ and $B_y$
HAL 3726	Analog	$B_y$ and $B_z$
HAL 3727	Analog	$B_x$ and $B_z$
HAL 3735	PWM and SENT	$B_x$ and $B_y$
HAL 3736	PWM and SENT	$B_y$ and $B_z$
HAL 3737	PWM and SENT	$B_x$ and $B_z$

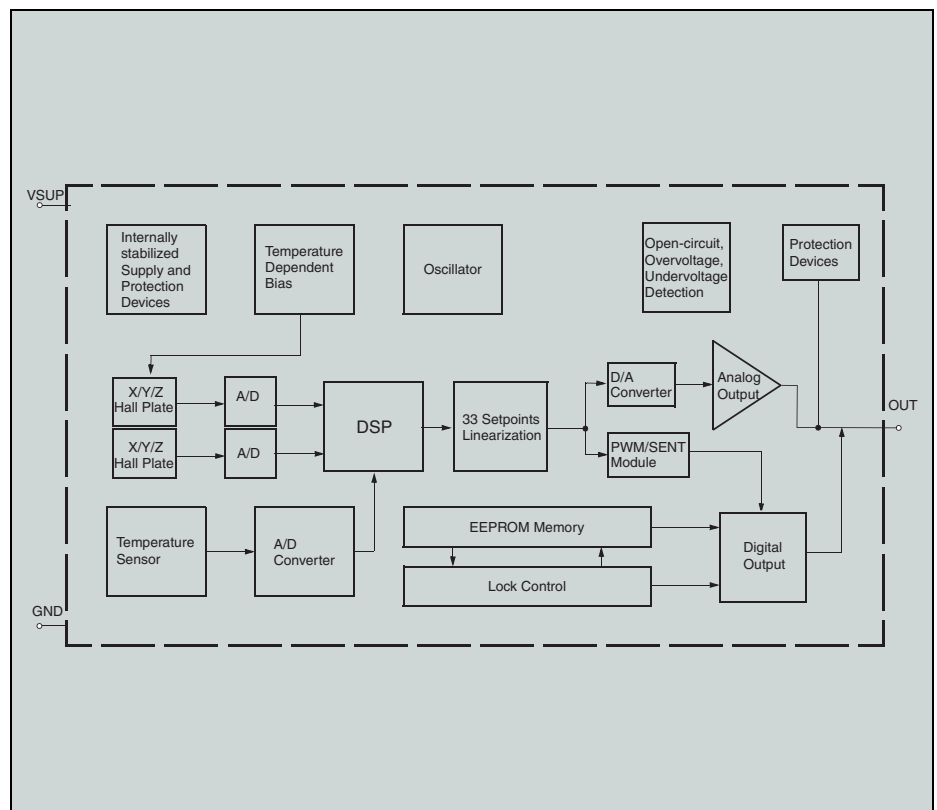


Fig. 1: Block diagram of the HAL 37xy

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Edition May 15, 2014; Order No. PI000149\_001EN