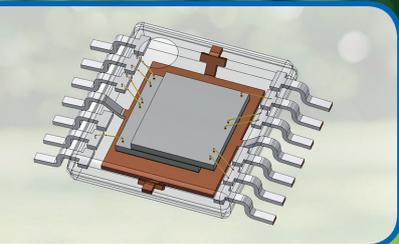


# HAR<sup>®</sup> 24xy

## High-Precision Dual-Die Linear Hall-Effect Sensors in Ultra-Thin SMD Package



HAR 24xy is a dual-die programmable linear Hall-effect sensor family available in the TSSOP14 package with a package height of less than 1 mm. Each sensor provides true redundancy as it consists of two independent dies stacked in a single package. The stacked-die architecture ensures that both dies occupy the same magnetic field position, thus generating synchronous measurement outputs.

The HAR 24xy contains two HAL 24xy Hall-effect sensor dies with ratiometric analog or PWM output. For each individual die, major characteristics like magnetic field range, sensitivity, output quiescent voltage (output voltage at  $B = 0$  mT), and output voltage range are programmable in a non-volatile memory.

The HAR 24xy offers 16 setpoints to change the output characteristics from linear to arbitrary or vice versa. It features a temperature-compensated Hall plate with spinning current offset compensation, an A/D converter, digital signal processing, a D/A converter with output driver (HAR 2425), a PWM output module (HAR 2455), an EEPROM with redundancy and lock function for calibration data, a serial interface for programming the EEPROM, and protection devices at all pins.

Due to internal digital signal processing, the impact of analog offsets, temperature shifts, and mechanical stress is minimized.

Temperature compensation can be fit to all common magnetic materials by programming first- and second-order temperature coefficients of the sensor sensitivity. Offset drift over temperature generated by the customer application can be compensated as well. This enables operation over the full temperature range with high accuracy.

The HAR 2425 provides redundant output voltages proportional to the magnetic flux through the Hall plates and proportional to the supply voltage (ratiometric behavior). The HAR 2455 offers redundant PWM outputs.

The sensors are designed for hostile industrial and automotive applications and operate with 5 V supply voltage in the junction temperature range from  $-40$  °C up to  $170$  °C. The HAR 24xy family is available in the ultra-thin TSSOP14-1 package.

### Features for each Die

- ◆ Analog output (HAR 2425) or PWM output (HAR 2455)
- ◆ Magnetic field measurements in the range up to  $\pm 200$  mT
- ◆ 16 setpoints for various output signal shapes
- ◆ Customer-programmable magnetic characteristics
- ◆ Programmable temperature compensation for sensitivity and offset
- ◆ Low output voltage drifts over temperature
- ◆ Programmable clamping function
- ◆ Programming and operation of multiple sensors with a shared supply line
- ◆ Active detection of output short between two sensors
- ◆ Operates with static magnetic fields and dynamic magnetic fields up to 2 kHz
- ◆ Active open-circuit (ground and supply line-break detection), overvoltage and undervoltage protection, short-circuit protected push-pull output

# HAR 24xy



## Major Applications

Due to the full redundancy, HAR 24xy can address most distance, angular and linear movement measurements in safety-critical applications. It targets especially:

- ◆ Throttle position, pedal position, steering torque and EGR applications
- ◆ Magnetic field and current measurement with appropriate sensitivity programming for each die

## Development Tools

Each die can be programmed during the final manufacturing process by adjusting the output signals directly to the input signal (like mechanical angle, distance, or current).

With this calibration procedure, the tolerances of the sensor, the magnet, and the mechanical positioning can be compensated in the final assembly.

Micronas offers an easy-to-use application kit:

- ◆ Micronas programmer board (HAL-APB V1.5)
- ◆ LabVIEW™ programming software for Windows® including Sub VIs

## System Architecture

HAR 24xy contains two integrated dies with independent power supply pins. The external magnetic-field component perpendicular to the branded side of the package generates a Hall voltage. For each die this voltage is converted into a digital value, processed in the DSP unit according to the settings of the EEPROM registers, converted back into an analog voltage and buffered by a push-pull output transistor stage (HAR 2425) or is output as PWM signal (HAR 2455).

The output characteristic can be adjusted by programming the EEPROM.

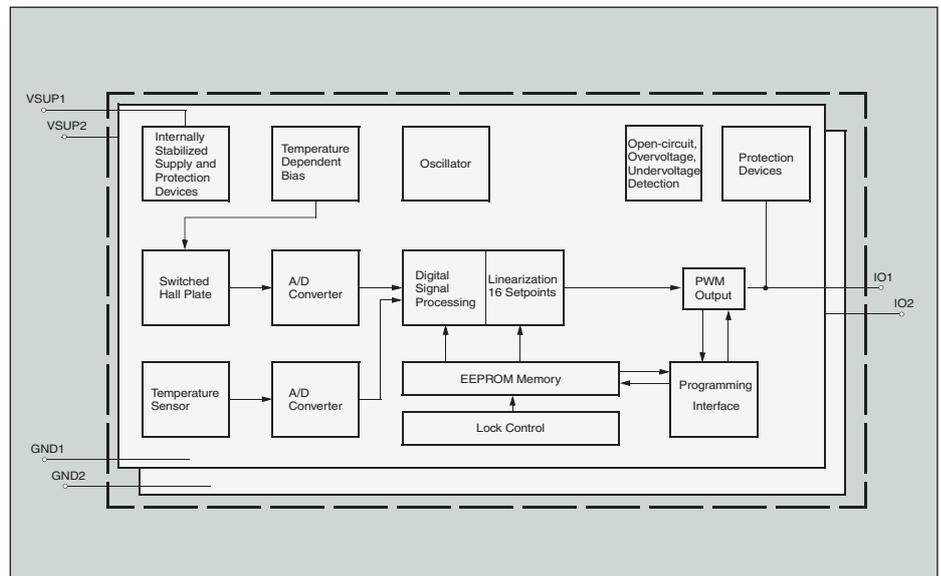


Fig. 1: Block diagram of the HAR 2425 with ratiometric analog output

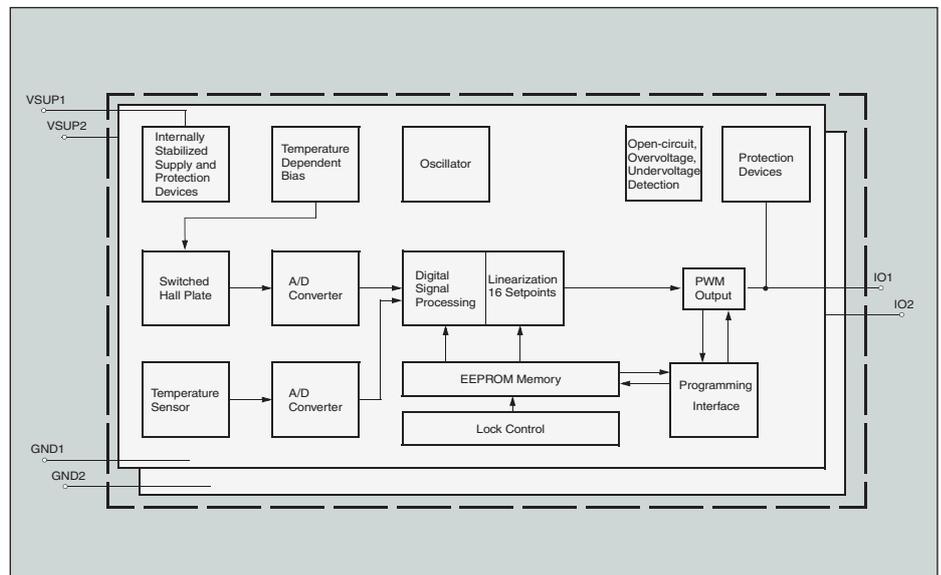


Fig. 2: Block diagram of the HAR 2455 with PWM output

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