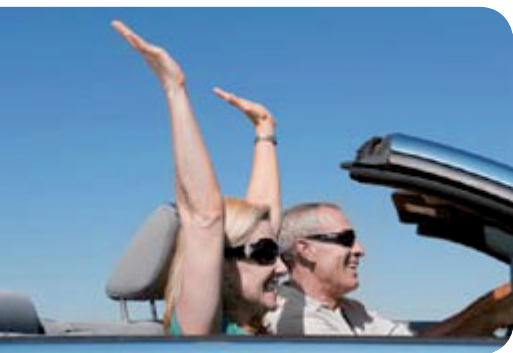




Explore Intelligent Technologies

Sensors and Embedded Microcontrollers
for Automotive and Industrial 2011





Company

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About Micronas

Company

Micronas (SIX Swiss Exchange: MASN), global leading in the field of Hall-effect sensors, develops and produces trendsetting sensor and IC system solutions for automotive and industrial electronics. While the holding company is headquartered in Zurich (Switzerland), operational headquarters are based in Freiburg (Germany).

We at Micronas meet global needs and aim at high targets, especially in the environmental sector. We are striving to create extraordinary products out of innovative ideas, comprehensive expertise and the appropriate technology. One of the central core benefits for our customers is the performance of our sensors and embedded microcontrollers. They make vehicles more efficient, reduce pollutant emissions and material usage in automotive and industrial applications and replace mechanical switches as well as potentiometers. Micronas develops key technologies for the future and thus contributes to the success of the end-product.

We are an internationally operating semiconductor manufacturer with the communication structure of a medium-sized enterprise and we are well equipped with the financial resources needed for our business. Short decision making processes in combination with an open information culture are significant for our dynamic company. Currently, about 900 employees support us on the exciting way from the idea right through to the product.



Sensor solutions from Micronas – from the idea to the finished product

Micronas GmbH is one of the rare manufacturers worldwide that is able to develop and produce semiconductor solutions literally under one roof. Innovative ideas from top-class engineers are realized just a few meters away by the site's own plant including front-end, back-end and final testing in the operational headquarter Freiburg, Germany.

Supply of the 500 millionth linear Hall sensor

In May 2010, Micronas delivered the 500 millionth linear Hall sensor of the HAL 8xy family. The HAL 8xy family is mainly used in cars to control throttle valves and adjust headlights, as well as in electrical power steering systems and fuel level measurement. The success of these linear Hall sensors is based on their programmability via an EEPROM (electrically erasable programmable read-only memory) on the chip itself – which is a unique feature – and their resistance to a wide range of junction temperatures from -40 to $+170$ °C.

Key figures as at December 31, 2010

Around 900 employees

CHF 190 million net sales

CHF 6.7 million profit for the period

Quality has Top Priority

We do not make compromises – and therefore aim to zero ppm. The success and the satisfaction of our customers is our measure of quality. We deliver our customers with high-grade products at reasonable prices and with best support. Therefore, we make a great effort to ensure highest quality and reliability. The immediate reaction to quality matters has top priority. Everyone here at Micronas is brought to report quality issues before they could affect our products corresponding to our principle - prevention instead of correction.

Our quality management is geared to the international series of standards ISO 16949 and fulfills the high requirements of the automotive industry. Periodically, key figures are determined and audits are held to assess its efficiency.



We carry Responsibility

As an international company, we have a global responsibility to protect the environment. Our economic success-oriented acting has to meet ethic and ecological standards. Our primary goal is to prevent and avoid environmental impacts and safety risks during normal operation and in the event of an emergency, rather than limiting effects or damages. All of our activities are targeted not only to a short time but to sustainable process optimizing and behavior changing. This requires making optimum use of the resources we consume and a forward-looking assessment of potential environmental impacts in all cases.

The group's commitment to environmental protection dates back long time ago: Since as early as the mid-80s, a dedicated department has been working on the issues addressed and standardized by ISO 14001 and EMAS. Micronas finally was first certified to ISO 14001 for the first time in 2000 and to EMAS in 2002. The recent certifications confirm that the results of the efforts undertaken meet all requirements of both standards.

AAA Certificate

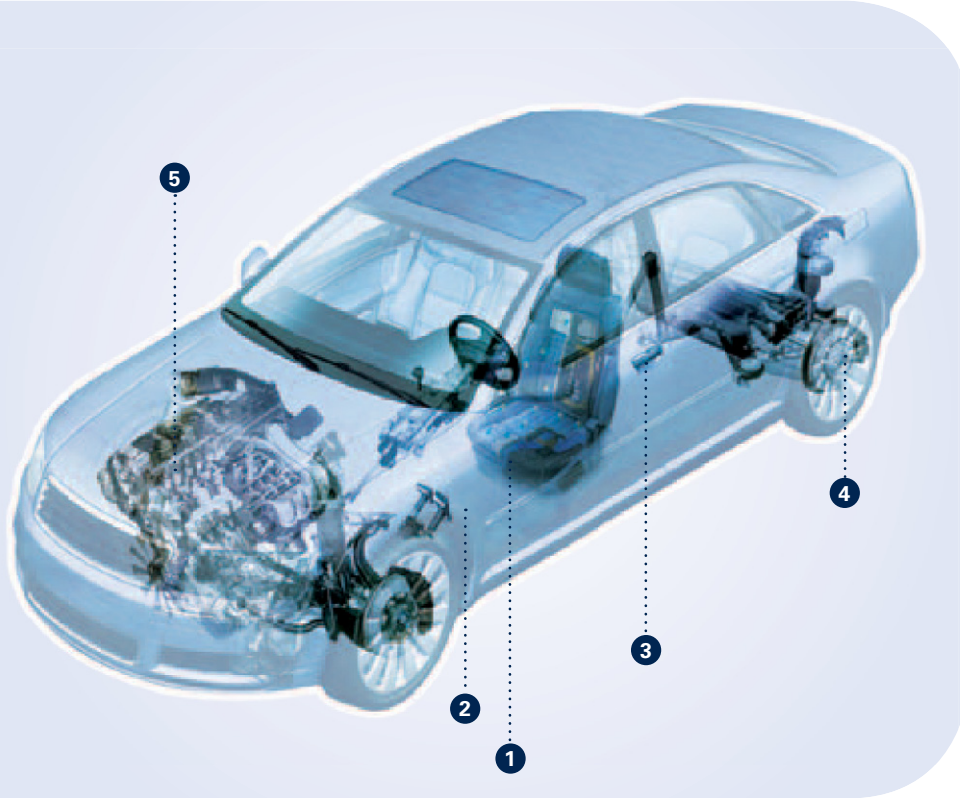
ACE Risk Management Services also affirms the high standard of property loss control by the issuance of the AAA Certificate to Micronas.



Application Fields

Automotive

Company



In automotive electronics, Micronas is focusing both on highly integrated control systems for car interior applications, as well as on sensor systems for a wide range of applications. They require on one hand rather simple Hall switches to detect a position and on the other hand quite complex linear Hall-effect sensors for the measurement of a travel distance or of a rotational movement. Beyond that, with its high-voltage microcontroller HVC 2480B Micronas offers an utmost level of integrated functionality applicable at various places in the car, e.g. LED fan control for headlights, automated grill module (AGM), window lifter, door lock module, sunroof control, etc.

The variety of integrated modules and functions (all-in-one solution) minimizes the number of required external components in most cases almost to zero. Thus, the reliability of the entire system increases because of the omission or reduction of soldered and mechanical connections as well as PCB area leading to less points of attack for electrical and mechanical disturbances. This becomes noticeable in a low effort of resources, costs and time for the development, as well as low costs and effort to steadily use the system by providing a maximum of energy efficiency and environmental compatibility.

1. Comfort

Micronas' large portfolio of Hall-sensors offering cutting-edge motor control solutions with professional support enables a wide variety of reliable, low-cost and energy-efficient motor control applications.

HAL 502 BLDC Motor (Commutation)

2. Clutch

Micronas offers sensor solutions for contactless measurement providing low sensitivity against vibration and temperature, e.g. for clutch position measurement, motor management and parking brake applications.

HAL 855 Movement Detection in Clutch

HAL 1823 Movement Detection in Dual-Clutch

HAL 549 End-Position Detection in Clutch

3. Body

Micronas develops trend-setting sensor solutions enabling advanced body and chassis systems. Micronas' sensor portfolio has what you're looking for to finish your latest design in body control modules or door, seat and mirror control.

HAL 526 Power Window

HAL 566 Central Lock

HAL 574 Roof Rack Detection

4. Brake

Micronas' products are designed for long life time and high reliability. Brake light, brake cylinder position, brake pedal position or wheel speed are typical applications for sensor solutions from Micronas.

HAL 506 Brake Pedal

HAL 817 Pedal Sensor

5. Engine

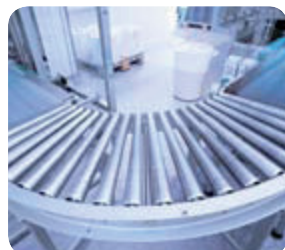
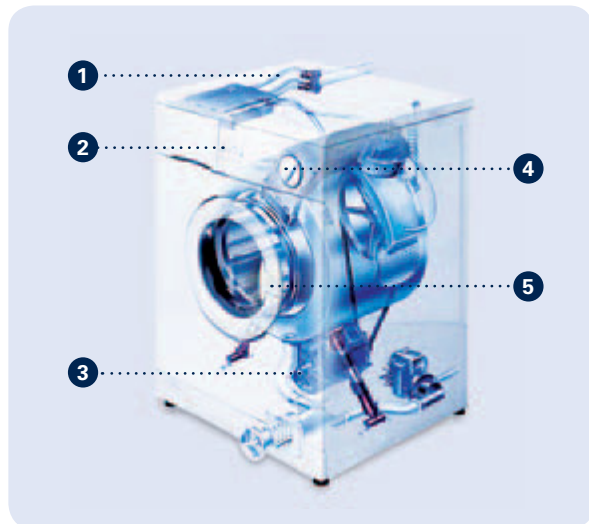
Solutions from Micronas help sensor modules to boost their performance, especially in terms of network capability. Micronas offers optimized system solutions, e.g. based on its LIN-capable HVC microcontroller.

HVC 2480B General-Purpose Actuator

Application Fields

Company

Industrial



White Goods

For reliable and energy-efficient automatic operations Micronas offers sensor solutions enabling advanced motor control for increased power efficiency and quieter operation. Developed with safety in mind.

1. HAL 210 / HAL 506 Water Flow Meter
2. HAL 201 Selection Switch
3. HAL 202 BLDC Motor (Commutation)
4. HAL 401 Control Knob
5. HAL 565 Door Lock

Heavy Machines

Electrification in heavy machines has today become standard. Micronas offers sensor solutions developed to meet the demands for lifetime and reliability under high vibration and extreme temperature conditions.

HAL 805 Industrial Joystick

Factory Automation

Modern factory automation equipment needs to measure speed and position in order to transmit the data to the central microcontroller and therefore to allow feedback. Due to its robustness and the contactless measurement itself Micronas Hall Sensors are the perfect choice for the automation industry.

HAL502 Linear Encoder

Home Automation

Comfort today gains increasing importance. Home automation devices for remote monitoring and control are more and more needed. Micronas' products offer reliable sensor solutions providing power efficiency at minimal size.

HAL 202 Rolling Shutter Position Detection

Building Automation

Energy efficiency is becoming a key criteria for modern applications in building automation. Hall-effect sensors from Micronas help to make HVAC systems more efficient by enabling a closed-loop system.

HAL 825 Heating and Ventilation Systems

Micronas' sensor and microcontroller solutions are also sought after in non-automotive applications. They are widely used in all types of white goods, such as washing machines, tumble dryers, and induction cookers, as well as heating and cooling systems. Further areas of applications can be found in the industrial arena, for example to control robots or to automate assembly equipment. Hall-effect sensors can be found in almost any machine that needs to measure position, linear or rotational movement or even current. By means of the Hall-effect other parameters can also be measured indirectly like rpm, leveling, pressure, force or even torque.

More and more industrial and white goods applications require reliable sensing solutions and even smart sensors reflect the market demand for energy efficient solutions. With the high integration level of our HVC 2480B embedded microcontroller we are directly targeting a significant reduction on system cost level by means of reduced weight, space and overall components of the system. On top of that, the overall quality of the system increases. With both product lines Hall-effect sensors as well as embedded microcontrollers we can offer our customers attractive system solutions.

Overview of Major Product Families

Company

Hall Switch Families

Single Hall Plate

HAL 1xy

- 3-wire output
- Different switching points
- $T_J = -20$ to $125\text{ }^{\circ}\text{C}$
- TO92 or SOT89 package

HAL 2xy

- Open-drain output
- Chopper stabilized
- Different switching points
- $T_J = -40$ to $140\text{ }^{\circ}\text{C}$
- TO92 or SOT89 package

HAL 5xy

- 3-wire- and 2-wire open-drain output
- Chopper stabilized
- High-precision thresholds
- Different switching points
- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- TO92 or SOT89 package

Dual Hall Plate

HAL 3x0

- Open-drain output
- Zero speed differential sensor
- Chopper stabilized
- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- TO92 or SOT89 package

HAL 7xy

- Open-drain output
- Speed and direction signal
- Chopper stabilized
- Different switching points
- $T_J = -40$ to $140\text{ }^{\circ}\text{C}$
- SOT89 package

Linear Hall Sensor Families

Single Hall Plate

HAL 4xy

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- SOT89 package

HAL 8xy

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- SOT89 package
- Programmable (EEPROM)

HAL 18xy

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- TO92 or SOT89 package
- Ratiometric analog output

HAL 4x1

- Differential output
- Magnetic flux range: $-50\ldots+50\text{ mT}$
- Chopper stabilized

HAL 81x/82x

- Different linear output formats (Analog, PWM)
- High accuracy

HAL 85x

- Arbitrary Output Characteristic
- Different output formats (PWM, Serial Output)

HAL 880

- Analog Output

HAL 1820

- Programmable (EEPROM)
- Value-optimized version (10 bit)

HAL 1821/22/23

- Pre-configured sensitivity (EEPROM)
- Value-optimized version (10 bit)

HAL 28xy

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- TO92 package
- Programmable (EEPROM)
- High-precision sensors
- Built-in RISC processor
- Digital signal processing
- Built-in temperature sensor

HAL 38xy

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- SOIC8 package
- Programmable (EEPROM)

HAL 2810

- LIN 2.0 interface
- 12-bit resolution

HAL 283x

- SENT interface
- Up to 16-bit resolution

HAL 2850

- PWM output
- 12-bit resolution

HAL 3855

- Position and distance measurement
- Programmable characteristics in a non-volatile memory

Overview of Major Product Families

Company

Direct Angle Sensors

HAL 36xy

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- SOIC8 package
- Programmable (EEPROM)

HAL 3625

- Ratiometric output
- Measurement of rotating angles in a range of 0° to 360°
- High accuracy
- Programmable characteristics in a non-volatile memory

Current Sensors

CUR 310x

- $T_J = -40$ to $170\text{ }^{\circ}\text{C}$
- TO92 or SOIC8 package

CUR 3105

- Ratiometric output
- High-precision current transducer
- Digital signal processing

CUR 315x

- $T_J = -40$ to $140\text{ }^{\circ}\text{C}$
- TO92 package

CUR 3150

- PWM output
- High-precision current transducer
- Sensitivity error $\pm 3\%$

CUR 3155

- PWM output
- Sensitivity error $\pm 1\%$

Gas Sensors

GAS 85xyB

- $T_J = -40$ to $85\text{ }^{\circ}\text{C}$
- LCC28 package
- 2 independent gas sensing units
- Target gases: NO_2 , NH_3 , H_2 , VOC, and CO_2
- Integrated temperature and relative humidity sensor
- Digital SPI interface

GAS 8514B

- Target gases: H_2 + NH_3

GAS 8516B

- Target gases: H_2 + NO_2

GAS 8534B

- Target gases: CO_2 + NH_3

GAS 8546B

- Target gases: NH_3 + NO_2

GAS 8555B

- Target gas: VOC

Embedded Microcontrollers

HVC 24xyB

- $T_J = -40$ to $125\text{ }^{\circ}\text{C}$
- QFN40 package

HVC 2480B

- Direct 12 V operation
- Integrated triple half-bridge driver stage
- Directly driving motors with up to $3 \times 300\text{ mA}$
- Driving of motors with higher current via external half-bridges
- LIN 2.x transceiver

Introduction

Hall-Effect Sensors

Edwin Herbert Hall (1855–1938) was an US American physicist. In 1879 he made a revolutionary discovery while working on his dissertation at the Harvard University: In his experiments Hall exposed thin gold leaf on a glass plate and taped off the gold leaf at points down its length. Then he perpendicularly applied a magnetic field. The effect was a potential difference on opposite sides of this thin sheet of gold through which flew an electric current. Later he used various other conducting and semiconducting materials. Little by little Hall discovered the background of this phenomenon. The electrons of the current flow in an electrical conductor are diverted from their normal direct path by an outer magnetic field perpendicular to their motion. Due to the so-called Lorentz force, a potential difference is created, proportional to the field strength of the magnetic field and to the current strength. Since that time the Hall-effect carries the name of its discoverer.

Nowadays, Silicon is used almost exclusively as a basic material for the technical implementation of magnetic field sensors, as the Hall-effect is most pronounced in semiconductors. In modern Hall-effect sensor devices, the magnetic field sensitive Hall element is combined with the signal processing on a single silicon chip. Owing to their various advantages like contactless sensing and high reliability, Hall-effect sensors are indispensable components in the automotive and industrial sector. Three different types of sensor architecture are available today:

Hall Switches

The simplest application is to use the sensor as a “digital switch”. The magnetic field strength is measured and compared with a fixed threshold level predefined or programmable in the sensor. As soon as this value is exceeded (switching point) the switching state at the output of the sensor changes and the output transistor is switched on or off. Two types of switches are available. 3-wire version with an open-drain output or 2-wire versions with current-coded output.

Linear Hall Sensors

Linear Hall sensors differ from the switches as follows: Depending on the magnetic field, the output does not have a discrete switching state, but provides a signal proportional to the magnetic field strength. This output signal can be delivered as an analog output voltage, a pulse-width-modulated signal (PWM) or even as a modern bus protocol (LIN, SENT).

Direct Angle Sensors

New types of Hall-effect sensors do not measure the absolute magnetic field anymore. So-called direct angle sensors capture the field vector by measuring sine and cosine components of the magnetic field. This is possible due to the new 3D-HAL technology from Micronas. Vertical Hall plates measure the magnetic field components in the chip plane and not the components perpendicular to the chip surface. These kind of sensors provide angular and position information directly via an output signal proportional to the measured angle or position.



Functions

Position Detection

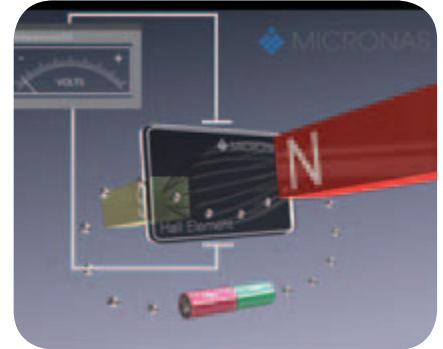
Hall switches are commonly used for end-position detection. The sensor recognizes the presence of a magnetic field by signaling an ON/OFF state. Therefore Hall switches are widely used to replace micro switches, offering superior quality and durability performance.

Linear Movement

In many applications, linear sensors are used that provide a signal proportional to the linear movement being measured. The output signals can be analog or in digital formats. Hall-effect sensors are widely used to replace conventional potentiometers due to these proven advantages.

Current Measurement

Depending on the application requirements, linear Hall sensors can either be utilized to indicate max/min levels or the direct current level providing an analog output value proportional to the current level.



Generic Applications

RPM Measurement

When applying a magnet to a propeller or tooth wheel, the Hall-effect sensor (typically a Hall switch) detects the change of the magnetic field (ON/OFF state) and counts these changes.

Rotary Position

Typically linear and direct angle Hall sensors are used in applications where a rotary position has to be continuously measured. Both sensor types output a signal, which is proportional to the angular positions. Linear Hall sensors are typically used for smaller angular ranges whereas a direct angle sensor is well suited for angles up to 360°.

Leveling

The measurement of a liquid level is carried out via detection of either a rotary position (when a float gauge module is used) or a linear movement.

Force/Pressure Measurement

The Hall-effect sensor detects the displacement of a spring or a membrane when applying force or pressure to it. The displacement is nothing but a linear movement.

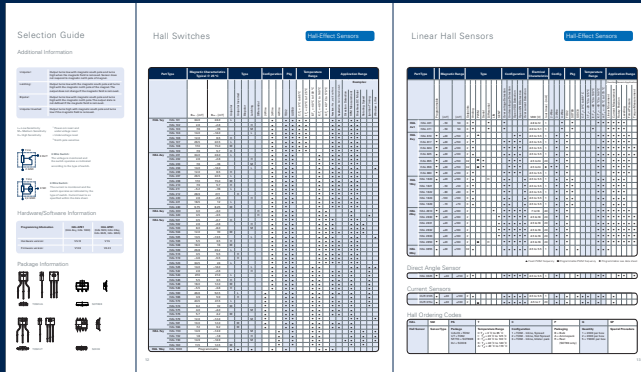
Torque Measurement

Torque measurement represents a subform of force measurement. When a force or torque is applied, the displacement of one object or two objects adjacent to each other can be measured by a linear Hall sensor.

Selection Guide

Hall-Effect Sensors

Guide Linear Hall Sensors



Guide Hall Switches

Guide Current Sensors

Functions

- Position Detection
- Linear Movement
- Current Measurement

Generic Applications

- RPM Measurement
- Rotary Position
- Leveling
- Force/Pressure Measurement
- Torque Measurement



PRESSURE



EMBEDDED
CONTROLLER



HUMIDITY



GAS



POSITION



CURRENT



TEMPERATURE



TORQUE



DISTANCE



ANGLE

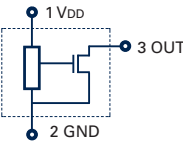
Selection Guide

Additional Information

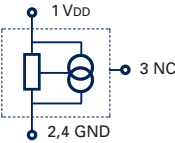
Unipolar:	Output turns low with magnetic south pole and turns high when the magnetic field is removed. Sensor does not respond to magnetic north pole of magnet.
Latching:	Output turns low with the magnetic south pole and turns high with the magnetic north pole of the magnet. The output does not change if the magnetic field is removed.
Bipolar:	Output turns low with magnetic south pole and turns high with the magnetic north pole. The output state is not defined if the magnetic field is removed.
Unipolar Inverted	Output turns high with magnetic south pole and turns low if the magnetic field is removed.

L= Low Sensitivity
M= Medium Sensitivity
H= High Sensitivity

¹ Power-on reset and undervoltage reset
² Undervoltage reset
³ North pole sensitive



3-Wire Switch:
The voltage is monitored and the switch operates as indicated according to the type of switch.

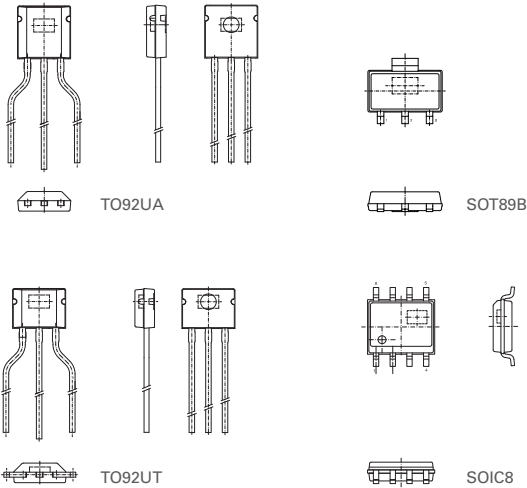


2-Wire Switch:
The current is monitored and the switch operates as indicated by the type of switch. Current level is as specified within the data sheet.

Hardware/Software Information

Programming Information	HAL APB1 (HAL 8xy, HAL 1000)	HAL APB1 (HAL1820, HAL 28xy, HAL 3625, HAL 3855)
Hardware version:	V5.10	V1.5
Firmware version:	V1.32	V2.23

Package Information



Hall Switches

Hall-Effect Sensors

Part Type		Magnetic Characteristics Typical @ 25 °C		Type					Configuration			Pkg		Temperature Range					Application Range								
		B _{ON} – [mT]	B _{ON} – [mT]	Unipolar	Unipolar Inverted	Biopolar	Latching	Differential	2-Wire	3-Wire	4-Wire	TO92	SOT89	C: T _J = 0 °C to 85 °C	I: T _J = -20 °C to 125 °C	E: T _J = -40 °C to 100 °C	K: T _J = -40 °C to 140 °C	A: T _J = -40 °C to 170 °C	Function: Pos. and End-Point	Application: Solid State Switch	Direction Detection	RPM Measurement	Brushless DC Motor	Rotating Speed	Ignition Timing	Window Lifter	
HAL 1xy	HAL 101	34.0	24.0	L						•		•	•	•	•				•	•		•	•				
	HAL 102	2.6	–2.6				H			•		•	•	•	•				•	•		•	•				
	HAL 103	7.6	–7.6				M			•		•	•	•	•				•	•		•	•				
	HAL 104	14.0	–14.0				L			•		•	•	•	•				•	•		•	•				
	HAL 106	12.0	6.5	H						•		•	•	•	•				•	•		•	•				
	HAL 107	26.5	22.5	L						•		•	•	•	•				•	•		•	•				
	HAL 108	17.0	15.0	M						•		•	•	•	•				•	•		•	•				
	HAL 109	7.9	5.7	H						•		•	•	•	•				•	•		•	•				
HAL 2xy	HAL 201	34.0	24.0	L						•		•	•				•		•	•		•	•				
	HAL 202	2.6	–2.6				H			•		•	•				•		•	•		•	•				
	HAL 203	7.6	–7.6				M			•		•	•				•		•	•		•	•				
	HAL 204	14.0	–14.0				L			•		•	•						•	•		•	•			•	
	HAL 206	12.0	6.5	H						•		•	•				•		•	•		•	•				
	HAL 207	26.5	22.5	L						•		•	•				•		•	•		•	•				
	HAL 208	17.0	15.0	M						•		•	•				•		•	•		•	•				
	HAL 210	7.9	5.7	H						•		•	•				•		•	•		•	•				
	HAL 211	–5.2	–7.6	L						•		•	•				•		•	•		•	•				
	HAL 212	28.9	27.1		H					•		•	•				•		•	•		•	•				
	HAL 220	2.6	–2.6				H			•		•	•				•		•	•		•	•				
	HAL 221	18.5	12	L						•		•	•				•		•	•		•	•				
	HAL 240	9.75	8.25	M						•		•	•				•		•	•		•	•				
HAL 3xy	HAL 300	3.0	–3.0					H		•		•	•				•	•				•					
	HAL 320	3.5	–3.5					H		•		•	•				•	•				•			•		
HAL 5xy	HAL 501	0.5	–0.7	H						•		•	•				•	•	•			•	•				
	HAL 502	2.6	–2.6				H			•		•	•				•	•	•			•	•		•		
	HAL 503	8.0	–8.0				M			•		•	•				•	•	•			•	•		•		
	HAL 504	12.0	7.0	M						•		•	•				•	•	•			•	•		•		
	HAL 505	13.5	–13.5				L			•		•	•				•	•	•			•	•			•	
	HAL 506	5.5	3.5	H						•		•	•				•	•	•			•	•				
	HAL 508	18.0	16	M						•		•	•				•	•	•			•	•				
	HAL 509	26.8	23.2	L						•		•	•				•	•	•			•	•				
	HAL 516	3.5	5.5		H					•		•	•				•	•	•			•	•				
	HAL 519	–3.6	–5.5		H					•		•	•				•	•	•			•	•				
	HAL 523	34.5	24	L						•		•	•				•	•	•			•	•				
	HAL 526	14.0	–14.0				L			•		•	•				•	•				•	•		•	•	
	HAL 542	2.6	–2.6				H			•		•	•				•	•	•			•	•		•		
	HAL 543	27.0	21.0	L						•		•	•				•	•	•			•	•		•		
	HAL 546	5.5	3.5	H						•		•	•				•	•	•			•	•		•		
	HAL 548	18.0	12.0	M						•		•	•				•	•	•			•	•		•		
	HAL 549	–5.5	–3.6	H						•		•	•				•	•	•			•	•		•		
	HAL 560	46.6	52.5		L					•			•	•				•	•	•			•	•		•	
	HAL 566	3.9	5.9		H					•			•	•				•	•	•			•	•		•	
	HAL 573	43.5	41.5	L						•			•	•				•	•	•			•	•		•	
	HAL 574	9.2	7.2	M						•			•	•				•	•	•			•	•		•	
	HAL 575	4.0	–4.0				M			•			•	•				•	•	•			•	•			
	HAL 576	5.7	4.2	M						•			•	•				•	•	•			•	•			
	HAL 579	12.0	–12.0				M			•			•	•				•	•	•			•	•			•
	HAL 581	10.0	12.0		M					•			•	•				•	•	•			•	•			
	HAL 584	7.2	9.2		M					•			•	•				•	•	•			•	•			
	HAL 7xy	HAL 700	14.9	–14.9				M				•		•				•	•				•	•		•	•
		HAL 702	1.8	–1.8				H				•		•				•	•				•	•		•	•
		HAL 730	14.9	–14.9				M				•		•				•	•			•	•		•	•	
		HAL 740	11.5	12.5	M							•		•	•				•	•			•	•		•	•
HAL 10xy	HAL 1000	Programmable		•	•		•			•		•	•				•	•	•								

Linear Hall Sensors

Hall-Effect Sensors

Part Type			Magnetic Range		Type						Configuration					Electrical Characteristics		Config.	Pkg			Temperature Range					Application Range													
		Programmable	[mT]	[mT]	Setpoints	Analog	PWM	Serial	Differential	LIN	SENT	Overvoltage Detection	Undervoltage Detection	Open VDD Detection	Open GND Detection	Overcurrent Detection	VDD [V]	Iout (max) - [mA]	2-Wire	3-Wire	4-Wire	TO92	SOT89	SOIC8	C: T _J = 0 °C to 85 °C	I: T _J = −20 °C to 125 °C	E: T _J = −40 °C to 100 °C	K: T _J = −40 °C to 140 °C	A: T _J = −40 °C to 170 °C	Linear Movement	Current Measurement	Rotary Position	Leveling	Force/Pressure	Torque Measurement					
HAL 4x1	HAL 401		−50	50	0	●			●			●					4.8 to 12	1			●		●					●	●	●	●	●	●	●						
	HAL 411		−50	50	0	●			●			●					4.9 to 5.1	1			●		●				●		●	●	●	●	●	●						
HAL 8xy	HAL 810	●	±30	±150	2		▲							●	●		4.5 to 5.5	1		●		●						●	●	●	●	●	●	●	●					
	HAL 817	●	±30	±150	2	●						●	●	●	●		4.5 to 5.5	1		●		●						●	●	●	●	●	●	●	●					
	HAL 824	●	±30	±100	2	●						●	●	●	●		4.5 to 5.5	1		●		●						●	●	●	●	●	●	●	●	●	●			
	HAL 825	●	±30	±100	2	●						●	●	●	●		4.5 to 5.5	1		●		●						●	●	●	●	●	●	●	●	●	●			
	HAL 855	●	±30	±150	32		■	●					●	●	●	●		4.5 to 14	20		●		●					●	●		●	●	●	●	●	●				
	HAL 856	●	±30	±150	32		■	●					●	●	●	●		4.5 to 14	◆	●	●		●					●	●		●	●	●	●	●	●				
	HAL 880	●	±30	±100	2	●						●	●	●	●		4.5 to 5.5	1		●		●						●	●		●	●	●	●	●	●				
HAL 18xy	HAL 1820	●	±20	±160	2	●						●	●			●	4.5 to 5.5	1		●		●	●					●	●		●	●	●	●	●	●				
	HAL 1821		−50	+50	0	●						●	●			●	4.5 to 5.5	1		●		●	●					●	●		●	●	●	●	●	●				
	HAL 1822		−80	+80	0	●						●	●			●	4.5 to 5.5	1		●		●	●					●	●		●	●	●	●	●	●				
	HAL 1823		−100	+100	0	●						●	●			●	4.5 to 5.5	1		●		●	●					●	●		●	●	●	●	●	●				
HAL 28xy	HAL 2810	●	±20	±160	2					●		●	●	●	●	●	7 to 18	40		●		●						●	●	●	●	●	●	●	●	●	●			
	HAL 2830	●	±20	±160	2						●	●	●	●	●	●	4.5 to 18	20		●		●						●	●	●	●	●	●	●	●	●	●	●		
	HAL 2831		±20	±160	2							●	●	●	●	●	4.5 to 18	20		●		●						●	●	●	●	●	●	●	●	●	●	●		
	HAL 2832		±20	±160	2							●	●	●	●	●	4.5 to 18	20		●		●						●	●	●	●	●	●	●	●	●	●	●		
	HAL 2833		±20	±160	2							●	●	●	●	●	4.5 to 18	20		●		●						●	●	●	●	●	●	●	●	●	●	●		
	HAL 2850	●	±20	±160	2		■						●	●	●	●	●	4.5 to 18	20		●		●					●	●	●	●	●	●	●	●	●	●	●		
HAL 38xy	HAL 3855	●	±30	±100	32	●						●	●	●	●	●	4.5 to 5.5	1		●		●		●				●	●	●										

▲ Fixed PWM frequency ■ Programmable PWM frequency ◆ Programmable: see data sheet

Direct Angle Sensor

HAL 3625	•	±30	±150	2	•						•	•	•	•	•	4.5 to 5.5	1	•				•									•
----------	---	-----	------	---	---	--	--	--	--	--	---	---	---	---	---	------------	---	---	--	--	--	---	--	--	--	--	--	--	--	--	---

Current Sensors

CUR 3105	•	±30	±100	2	•						•	•	•	•	•	4.5 to 5.5	1	•		•		•	•	•	•	•		•			
CUR 315x	•	±30	±160	2		■					•	•	•	•	•	4.5 to 7	20	•		•			•	•	•		•				

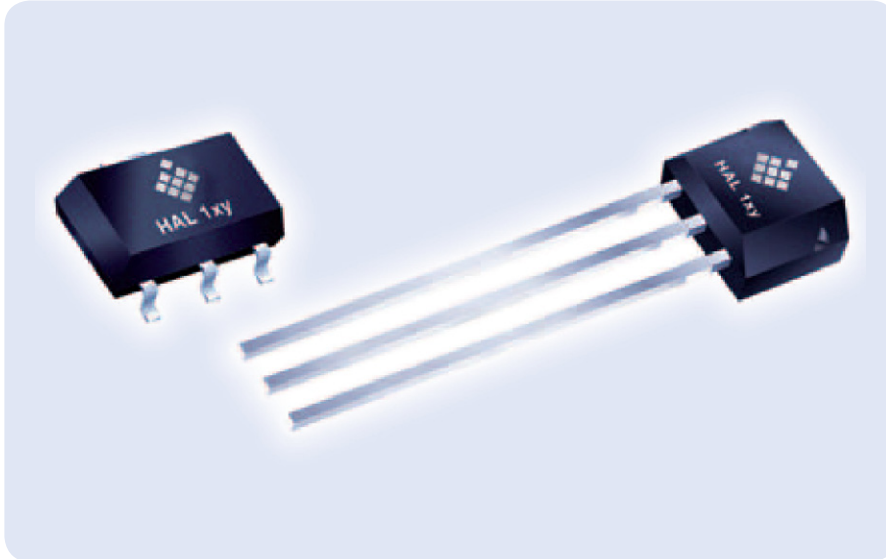
Hall Ordering Codes

HAL	502	PA	T	C	P	Q	SP
Hall Sensor	Sensor Type	Package UA/JQ = TO92 UT = TO92 SF/TQ = SOT89B DJ = SOIC8	Temperature Range C: T _J = 0 °C to 85 °C I: T _J = 20 °C to 125 °C E: T _J = 40 °C to 100 °C K: T _J = 40 °C to 140 °C A: T _J = 40 °C to 170 °C	Configuration 1 = TO92 - Inline, Spread 2 = TO92 - Inline, Not Spread 3 = TO92 - Inline, blister pack	Packaging B = Bulk A = Ammopack R = Reel (SOT89 only)	Quantity 1 = 2000 per box 2 = 2000 per box 5 = 15000 per box	Special Procedure

HAL 1xy

Hall-Effect Sensors

Hall Switch Family designed for White Goods and Industrial Applications



The HAL 1xy family represents easy-to-use Hall switches for white goods and industrial applications. It is the optimal system solution to detect a position by means of contactless measurement. In motor applications, the Hall sensor family is often used to derive an RPM measurement.

Technically, the sensors are produced in CMOS technology and include a temperature-compensated Hall plate with active offset compensation, a comparator, and an open-drain output transistor.

The comparator compares the actual magnetic flux through the Hall plate (Hall voltage) with the fixed reference values (switching points). Accordingly, the output transistor is switched on or off.

The active offset compensation leads to magnetic parameters which are robust against mechanical stress effects. In addition, the magnetic characteristics are constant in the full supply voltage and temperature range.

The HAL 1xy family is available in the SOT89B SMD package and in the leaded TO92UA package.

Features

- Temperature ranges:
C (Commercial, $T_J = 0\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$)
I (Industrial, $T_J = -20\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$)
- Operates from 3.8 V to 24 V supply voltage
- Operates with static magnetic fields and dynamic magnetic fields up to 10 kHz
- Overvoltage protection at all pins
- Reverse-voltage protection at V_{DD} pin
- Magnetic characteristics are robust against mechanical stress effects
- Short-circuit protected open-drain output by thermal shut down
- Constant switching points over a wide supply voltage and temperature range
- The decrease of magnetic flux density caused by rising temperature in the sensor system is compensated by a built-in negative temperature coefficient of the magnetic characteristics
- High temperature stability for home appliances and industrial applications
- High ESD rating

Functions

The HAL 1xy is the optimal system solution for application fields, such as:

- Position detection

Generic Applications

- RPM measurement

Application Examples

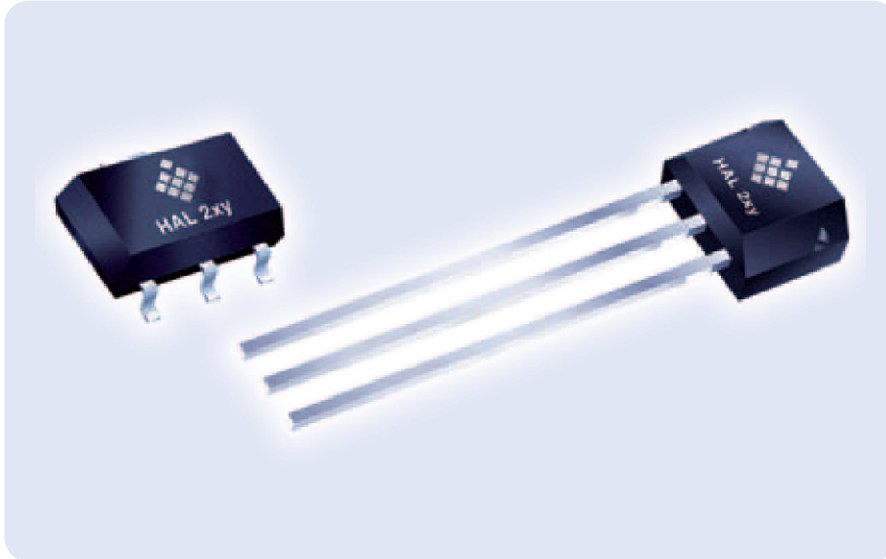
- Motor commutation
- Door lock
- Selector switches
- Speed control
- Flow meter



HAL 2xy

Hall-Effect Sensors

Value-Optimized Hall-Effect Sensor Family



The HAL 2xy Hall switch family is fully compatible to the HAL 1xy family, adding the general use for automotive in-cabin applications by expanding the temperature range to a level of $T_J = -40\text{ °C}$ up to 140 °C .

Like the HAL 1xy, the HAL 2xy Hall switch family is produced in CMOS technology. The sensors include a temperature-compensated Hall plate with active offset compensation, a comparator, and an open-drain output transistor.

The comparator compares the actual magnetic flux through the Hall plate (Hall voltage) with the fixed reference values (switching points). Accordingly, the output transistor is switched on or off.

The active offset compensation leads to magnetic parameters, which are robust against mechanical stress effects. In addition, the magnetic characteristics are constant in the full supply voltage and temperature range.

The sensors are designed for automotive and industrial applications and operate with supply voltages from 3.8 V to 24 V in the junction temperature range from -40 °C up to 140 °C .

The HAL 2xy family is dedicated to automotive and industrial applications available in the SMD package SOT89B and in the leaded version TO92UA.

Features

- Temperature range K:
 $T_J = -40\text{ °C}$ to 140 °C
- Operates from 3.8 V to 24 V supply voltage
- Operates with static magnetic fields and dynamic magnetic fields up to 10 kHz
- Overvoltage protection at all pins
- Reverse voltage protection at V_{DD} pin
- Magnetic characteristics are robust against mechanical stress effects
- Short-circuit protected open-drain output by thermal shut down
- Constant switching points over a wide supply voltage and temperature range
- The decrease of magnetic flux density caused by rising temperature in the sensor system is compensated by a built-in negative temperature coefficient of the magnetic characteristics
- High temperature stability for automotive or industrial applications
- High ESD rating

Functions

The HAL 2xy is the optimal system solution for applications, such as:

- Position detection

Generic Applications

- RPM measurement

Application Examples

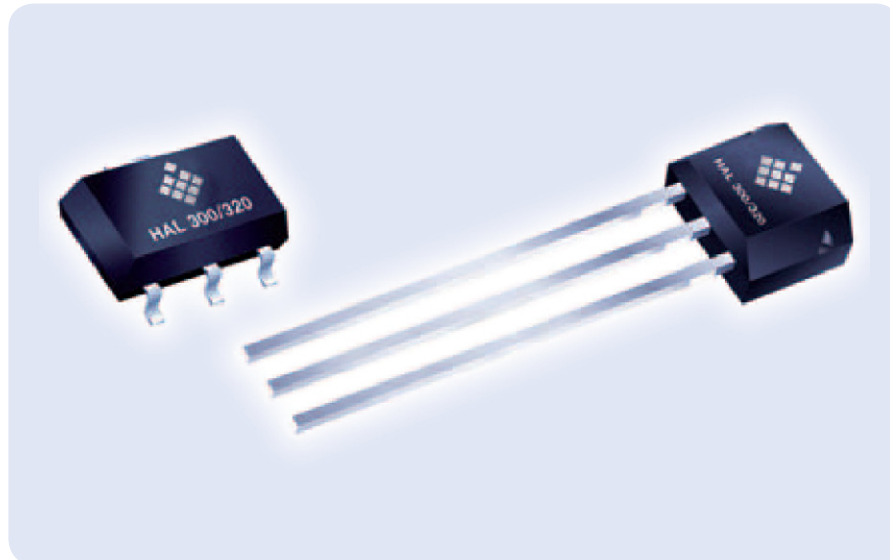
- Motor commutation
- Anti-squeeze protection (power-window)
- Speed control
- Flow meter
- Gear selector



HAL 300, HAL 320

Hall-Effect Sensors

Differential Hall-Effect Sensor ICs



The HAL 300 and the HAL 320 are differential Hall switches produced in CMOS technology. The sensors include two temperature-compensated Hall plates with active offset compensation, a differential amplifier with a Schmitt trigger, and an open-drain output transistor.

These differential sensors respond to spatial differences of the magnetic field. The Hall voltages at the two Hall plates, S_1 and S_2 , are amplified with a differential amplifier. The differential signal is compared with the actual switching level of the internal Schmitt trigger. Accordingly, the output transistor is switched on or off. The differential signal can be derived via a rotating multi-pole-ring in front of the branded side of the package (HAL 300) or via a magnet on the back side of the package generating a back-bias field at both Hall plates (HAL 320).

The active offset compensation leads to constant magnetic characteristics over supply voltage and temperature. The sensors are designed for automotive and industrial applications and operate with supply voltages from 4.5 V to 24 V in the junction temperature range $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$.

The sensors are available in the SMD package SOT89B and in the leaded version TO92UA.



Features

- Temperature range K:
 $T_J = -40\text{ }^{\circ}\text{C}$ to $170\text{ }^{\circ}\text{C}$
- Operates from 4.5 V to 24 V supply voltage
- Operates with static magnetic fields and dynamic magnetic fields up to 10 kHz
- Overvoltage protection at all pins
- Reverse voltage protection at V_{DD} pin
- Magnetic characteristics are robust against mechanical stress effects
- Short-circuit protected open-drain output by thermal shut down
- Constant switching points over a wide supply voltage and temperature range
- The decrease of magnetic flux density caused by rising temperature in the sensor system is compensated by a built-in negative temperature coefficient of the magnetic characteristics
- High temperature stability for automotive or industrial applications
- High ESD rating

Functions

The HAL 300 and HAL 320 are the optimal system solutions for applications such as:

- Position detection

Generic Applications

- RPM measurement

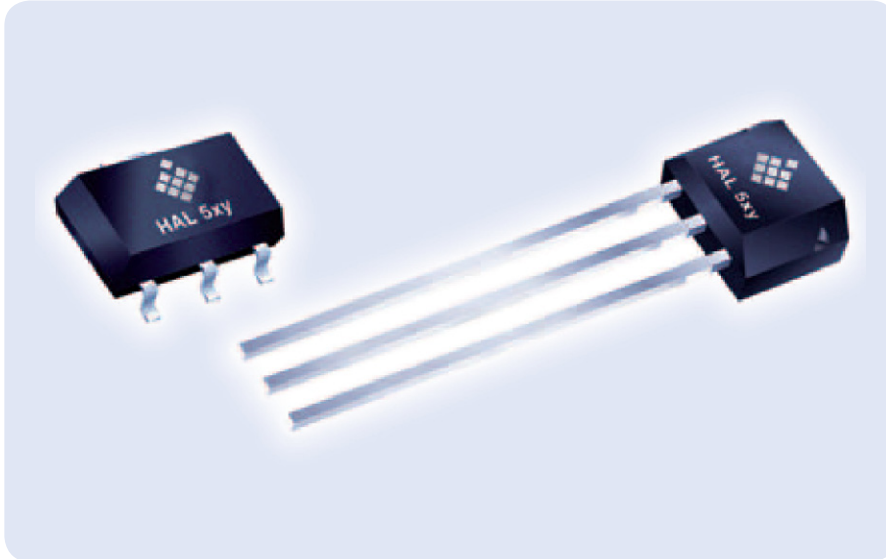
Application Examples

- Speed control
- Flow meter

HAL 5xy

Hall-Effect Sensors

High-Performance Hall-Effect Sensor Family



The HAL 5xy family complements Micronas' Hall sensor portfolio towards the higher end by offering an extended automotive temperature range of $T_J = -40\text{ }^{\circ}\text{C}$ to $170\text{ }^{\circ}\text{C}$. The HAL 5xy family consists of different Hall switches produced in CMOS technology. All sensors include a temperature-compensated Hall plate with active offset compensation and a comparator.

Depending on the family member, the switching state is output via an open-drain transistor or by altering the supply current level (two-wire Hall-effect sensor).

The comparator compares the actual magnetic flux through the Hall plate (Hall voltage) with the fixed reference values (switching points). Accordingly, the output transistor is switched on or off.

The sensors of this family differ in the switching behavior and the switching points. The active offset compensation leads to constant magnetic characteristics over supply voltage and temperature range. In addition, the magnetic parameters are robust against mechanical stress effects.

The sensors are designed for automotive and industrial applications and operate with supply voltages from 3.8 V to 24 V in the junction temperature range from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$.

All sensors are available in the SMD package SOT89B and in the leaded version TO92UA.

Features

- Operates from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ junction temperature
- Two- and three-wire versions
- Operates from 3.8 V to 24 V supply voltage
- Overvoltage protection at all pins
- Reverse voltage protection at V_{DD} pin
- Magnetic characteristics are robust regarding mechanical stress effects
- Short-circuit protected open-drain output by thermal shut down or current output for two-wire applications
- Operates with static magnetic fields and dynamic magnetic fields up to 10 kHz
- Constant switching points over a wide supply voltage range
- The decrease of magnetic flux density caused by rising temperature in the sensor system is compensated by a built-in negative temperature coefficient of the magnetic characteristics
- Ideal sensor for applications in extreme automotive and industrial environments
- EMC corresponding to ISO 7637

Functions

The HAL 5xy is the optimal system solution for applications, such as:

- Position detection

Generic Applications

- RPM measurement
- Powertrain

Application Examples

- Motor commutation
- Anti-squeeze protection (power-window)
- Speed control
- Buckle-switch
- Gear selector
- Steering lock



HAL 7xy

Hall-Effect Sensors

Dual Hall-Effect Sensors with two Independent Outputs



Features

- Operates from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ junction temperature
- Operates from 3.8 V to 24 V supply voltage
- Generation of a direction signal (HAL 730 only)
- Operates with static magnetic fields and dynamic magnetic fields up to 10 kHz
- Overvoltage protection at all pins
- Reverse-voltage protection at V_{DD} pin
- Magnetic characteristics are robust against mechanical stress effects
- Short-circuit protected open-drain outputs by thermal shut down
- Constant switching points over a wide supply voltage and temperature range
- The decrease of magnetic flux density caused by rising temperature in the sensor system is compensated by a built-in negative temperature coefficient of the magnetic characteristics
- High temperature stability for automotive or industrial applications
- High ESD rating

Functions

The HAL 7xy is the optimal system solution for applications, such as:

- Position and direction detection

Generic Applications

- RPM measurement

Application Examples

- Motor commutation
- Anti-squeeze protection
- Power-window

HAL 7xy is a family of monolithic integrated Hall-effect sensors manufactured in CMOS technology with two independent Hall plates S1 and S2. Both devices have two open-drain outputs.

The sensor HAL 730 is particularly featuring a count and a direction output. The count output operates like a single latched Hall switch according to the magnetic field present at Hall plate S1. The direction output indicates the direction of a linear or rotating movement of magnetic objects.

In combination with an active target providing a sequence of alternating magnetic north and south poles, the sensors generate the signals required to control position, speed, and direction of the target movement.

The HAL 7xy sensors include temperature compensation and active offset compensation. These features provide excellent stability and matching of the switching points in the presence of mechanical stress over the whole temperature and supply voltage range.

The HAL 7xy family is designed for automotive and industrial applications and operate with supply voltages from 3.8 V to 24 V in the junction temperature range from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$. The sensors are available in the SMD-package SOT89B.



HAL 1000

Hall-Effect Sensors

In-System Programmable Hall Switch



Compared with the standard Hall switches, the HAL 1000 offers full in-system programmability. The major sensor characteristics, the two switching points B_{ON} and B_{OFF} , and the output behavior are programmable for the specific application.

The HAL 1000 features a temperature-compensated Hall plate with chopped offset compensation, an A/D converter, digital signal processing, a push-pull output stage, an EEPROM memory with redundancy and lock function for the calibration data, a serial interface for programming the EEPROM, and protection devices at all pins.

Due to the digital signal processing, analog offsets, temperature shifts, and mechanical stress effects do not degrade the sensor accuracy.

The HAL 1000 is programmable by modulating the supply voltage. No additional programming pin is needed. The tolerances of the sensor, the magnet, and the mechanical positioning can be compensated via programming for the final assembly. This offers a low-cost alternative for all applications that presently require mechanical adjustment.

The sensor is designed for the use in harsh automotive and industrial applications with nominal supply voltage of 5 V in the junction temperature range from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$. The HAL 1000 is available in the leaded package TO92UT.

Features

- Operates from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ junction temperature
- High-precision Hall switch with programmable switching points and switching behavior
- Switching points programmable from -150 mT up to 150 mT in steps of 0.5% of the magnetic field range
- Multiple programmable magnetic characteristics in a non-volatile memory (EEPROM) with redundancy and lock function
- Temperature characteristics are programmable for matching all common magnetic materials
- Programming through modulation of the supply voltage
- Operates from 4.5 V up to 5.5 V supply voltage in specification and functions up to 8.5 V
- Operates with static magnetic fields and dynamic magnetic fields up to 2 kHz
- Magnetic characteristics are extremely robust against mechanical stress effects
- Overvoltage and reverse-voltage protection at all pins
- Short-circuit protected push-pull output
- EMC and ESD optimized design

Functions

The HAL 1000 is the optimal system solution for applications, such as:

- Position detection
- Current measurement

Application Examples

- End position detection
- Liquid-level detection
- Electronic fuse



HAL 4xy

Hall-Effect Sensors

Pre-configured Linear Hall-Effect Sensor IC
in CMOS Technology



Features

- Wide temperature range $T_J = -40\text{ }^{\circ}\text{C}$ to $170\text{ }^{\circ}\text{C}$ (HAL 401 only)
- Offset compensation at 147 kHz switching speed
- Low magnetic offset
- Extremely sensitive
- Operates from 4.8 to 12 V (HAL 401)/ 4.9 to 5.1 V (HAL 411) supply voltage
- Overvoltage protection
- Reverse voltage protection of V_{DD} pin
- Differential output
- Accurate absolute measurements of DC and low frequency magnetic fields
- On-chip temperature compensation

Functions

- Current measurement
- Linear movement detection

Generic Applications

- Rotary position
- Leveling

Application Examples

- Potentiometer replacement

The HAL 4xy family represents Hall sensors that include a temperature-compensated Hall plate with choppered offset compensation, two linear output stages, and protection devices.

The output voltage is proportional to the magnetic flux density through the Hall plate. The choppered offset compensation leads to stable magnetic characteristics over supply voltage and temperature.

The HAL 4x1 family can be used for magnetic field measurements, current measurements, and detection of any mechanical movement. Accurate angle measurements or distance measurements can also be done. The sensor is very robust and can be used in electrical and mechanical hostile environments.

The sensors are designed for automotive and industrial applications and operate in the junction temperature range from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ (HAL 401) / $-40\text{ }^{\circ}\text{C}$ up to $100\text{ }^{\circ}\text{C}$ (HAL 411) and are available in the SMD-package SOT89B.



HAL 81x

Hall-Effect Sensors

Programmable Linear Hall-Effect Sensors



The HAL 810 and the HAL 817 are programmable linear Hall-effect sensors which can be used for angle or distance measurements. The major characteristics are programmable in a non-volatile memory.

The HAL 817 has a ratiometric output characteristic; its output voltage is proportional to the magnetic flux and the supply voltage. The HAL 810 provides a pulse-width modulated (PWM) output signal.

The sensors feature a temperature-compensated Hall plate with chopped offset compensation, an A/D converter, an EEPROM memory with redundancy and lock function for the calibration data and protection devices at all pins. Due to the digital signal processing, analog offsets, temperature shifts, and mechanical stress do not degrade the sensor accuracy.

The tolerances of the sensor, the magnet, and the mechanical positioning can be compensated via programming by customer/user in the final assembly. This offers a low-cost alternative for all applications that presently need mechanical adjustment or laser trimming for calibration.

The HAL 810 and HAL 817 are designed for hostile automotive and industrial applications and operate with a supply voltage of typically 5 V in the junction temperature range from -40°C up to 170°C .

The sensors are available in the very small leaded packages TO92UT.



Over **500 million**
HAL 8xy sensors sold

Features

- Operation from -40°C up to 170°C junction temperature
- High-precision linear Hall effect sensors with digital signal processing
- PWM output signal with a refresh rate of typically 125 Hz and up to 11 bit resolution (HAL 810)
- D/A converter with output driver (HAL 817)
- Multiple programmable magnetic characteristics in a non-volatile memory (EEPROM) with redundancy and lock function
- Open-circuit feature (ground and supply line break detection)
- Overvoltage and undervoltage detection (HAL 817)
- For programming an individual sensor within several sensors in parallel to the same supply voltage, a selection can be done via the output pin (HAL 817)
- Programmable clamping function
- Programming via modulation of the supply voltage
- Temperature characteristics programmable for matching all common magnetic materials
- Operation with 4.5 V to 5.5 V supply voltage in specification and functions with up to 8.5 V
- Operation with static magnetic fields and dynamic magnetic fields
- Overvoltage and reverse-voltage protection at all pins
- Magnetic characteristics extremely robust against mechanical stress
- Short-circuit protected push-pull output
- EMC and ESD optimized design

Functions

The HAL 810 and HAL 817 are the optimal system solutions for applications such as:

- Linear movement
- Current measurement

Generic Applications

- Rotary position
- Leveling
- Force/pressure measurement

Application Examples

- Accelerator pedal
- Throttle position
- Exhaust gas recirculation

HAL 82x

Hall-Effect Sensors

High-Precision Programmable Hall-Effect Sensors



The HAL 824 and the HAL 825 expand the existing Hall-effect sensor family HAL 8xy. Both high-precision magnetic field sensors provide a ratiometric, linear output signal. This sensor family is designed to fulfill high requirements in respect of low temperature drifts of sensitivity and offset.

Due to the very low drifts of this sensor family, it can be used for applications with very high requirements on offset and sensitivity drift stability. This is mandatory for applications like throttle position detection, accelerator pedal sensing or current measurement.

The sensors provide either a ratiometric analog output signal or a multiplexed analog output. In multiplex analog output mode, the sensor transmits LSN and MSN of the output value separately. This enables the sensor to transmit a signal with 14-bit accuracy.

Major characteristics like magnetic field range, output format, sensitivity, the output voltage at zero magnetic field (VOQ), and the temperature coefficients can easily be adjusted to the magnetic circuit (linear and quadratic) by programming the non-volatile memory.

Both sensors are available in the very small leaded package TO92UT.



Features

- Operates from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ junction temperature
- Sensitivity drift over temperature less than $\pm 1\%$ (HAL 825 less than $\pm 2\%$)
- Offset drift over temperature less than $\pm 0.2\%$ (HAL 825 less than $\pm 0.3\%$) of VDD
- DNL of analog output ± 0.9 LSB (± 2 LSB for HAL 825)
- Wire break detection with $5\text{ k}\Omega$ pull-up or pull-down resistor
- Four programmable magnetic ranges: ± 30 , ± 60 , ± 80 , and $\pm 100\text{ mT}$
- Two programmable 3 dB filter frequencies: 500 Hz and 1 kHz
- Programmable sensitivity and offset (VOQ)
- 12-bit ratiometric analog output
- 14-bit signal path
- Digital signal processing
- Temperature characteristics programmable to match all common magnetic materials
- 13 customer data bits
- Programming by modulation of the supply voltage
- Operates from 4.5 V up to 5.5 V supply voltage
- Magnetic characteristics extremely robust against mechanical stress

Functions

Due to the sensor's versatile programming characteristics and low drifts, the HAL 82x is the optimal system solution for functions, such as:

- Linear movement
- Current measurement

Generic Applications

- Rotary position
- Leveling
- Force/pressure measurement
- Torque measurement

Application Examples

- Potentiometer replacement
- Accelerator pedal
- Throttle position
- Steering torque
- Exhaust gas recirculation

HAL 85x

Hall-Effect Sensors

Programmable Hall-Effect Sensors with Arbitrary Output



The HAL 85x complement the existing Hall-effect sensor family HAL 8xy. Both universal magnetic field sensors (HAL 855 and HAL 856) provide an arbitrary output signal. The sensors are produced in submicron CMOS technology.

In combination with a rotating or moving magnet, the sensors can be employed for angle, distance, and level measurements. The sensors provide either a pulse-width modulated (PWM) output signal or a serial Biphase-M output.

Major characteristics like magnetic field range, output characteristic, output format sensitivity, shift (duty cycle of the PWM output signal or the serial output word), PWM period, low and high current, and the temperature coefficients can easily be adjusted to the magnetic circuit (linear and quadratic) by programming the non-volatile memory. The output characteristic can be set via 32 setpoints.

The sensors were designed to translate a linear magnetic field into an arbitrary output signal or a non-linear magnetic field into a linear output signal.

The sensors are available in the very small leaded package TO92UT.



Over **500 million**
HAL 8xy sensors sold

Features

- Operates from -40°C up to 170°C junction temperature
- High-precision linear Hall-effect sensors with different output formats
- Various programmable magnetic characteristics with non-volatile memory
- Programmable output characteristic (32 setpoints)
- Programmable output formats (PWM or serial Biphase-M)
- Programmable PWM period
- Open-drain output for HAL 855
- Programmable output current source for HAL 856 (low and high current)
- Digital signal processing
- Temperature characteristics programmable for matching all common magnetic materials
- Programming by modulation of the supply voltage
- Lock function and built-in redundancy for EEPROM memory
- Operates from 4.5 V up to 14 V supply voltage
- Operates with static magnetic fields and dynamic magnetic fields up to 2 kHz
- Chopped offset compensation
- Overvoltage protection on all pins
- Reverse voltage protection on V_{DD} pins
- Magnetic characteristics extremely robust against mechanical stress
- Short-circuit protected output
- EMC-optimized design

Functions

Due to the sensor's versatile programming characteristics, the HAL 85x is the optimal system solution for functions such as:

- Linear movement

Generic Applications

- Rotary position
- Leveling
- Force/pressure measurement

Application Examples

- Liquid-Level detection
- Accelerator pedal
- Gear position
- Exhaust gas recirculation

HAL 880

Hall-Effect Sensors

Programmable Linear Hall-Effect Sensors



Features

- Operates from -40°C up to 170°C junction temperature
- Sensitivity drift over temperature less than $\pm 6\%$
- Offset drift over temperature less than $\pm 15 \mu\text{T/K}$
- Integral non-linearity error of output signal $\pm 1\%$ of VDD
- Ratiometric error of output signal $\pm 1\%$
- Low output noise of 25 mV peak-peak
- Wire-break detection with 5 k Ω pull-up or pull-down resistor
- Four programmable magnetic ranges: ± 30 , ± 60 , ± 80 , and ± 100 mT
- Two programmable 3 dB filter frequencies: 500 Hz and 1 kHz
- Programmable sensitivity and offset (VOQ)
- 12-bit ratiometric analog output
- Digital signal processing
- Temperature characteristics programmable to match all common magnetic materials
- 13 customer data bits
- Programming by modulation of the supply voltage
- Operates from 4.5 V up to 5.5 V supply voltage
- Magnetic characteristics extremely robust against mechanical stress

Functions

The HAL 880 is the optimal system solution for functions such as:

- Linear movement
- Current measurements

Generic Applications

- Rotary position
- Leveling



The HAL 880 is designed to fulfill the requirements of today's state-of-the-art applications for linear and angular measurements that require flexibility to compensate system tolerances.

Due to its programmability, it also offers the additional advantage of compensation of system tolerances. This is mandatory for applications like accelerator pedal sensing, current measurement, bending light or head light adjustment. The sensor provides a linear, ratiometric analog output signal with implemented wirebreak detection working with pull-up or pull-down resistor.

Major characteristics like magnetic-field range, sensitivity, VOQ (output voltage at zero magnetic field) and the temperature coefficients can easily be adjusted to the magnetic circuit (linear and quadratic) by programming the non-volatile memory.

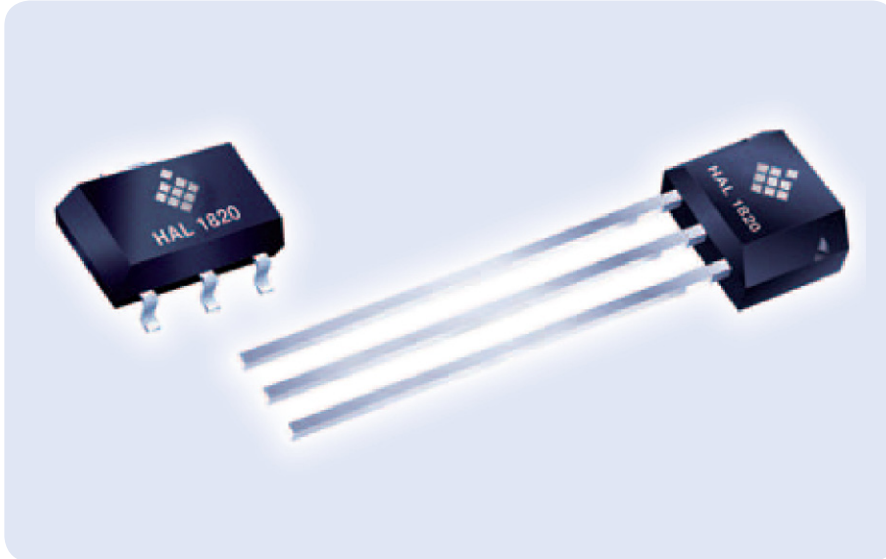
The HAL 880 is available in the very small leaded package TO92UT.



HAL 1820

Hall-Effect Sensors

Value-Optimized Programmable Linear Hall-Effect Sensor



The HAL 1820 is a new member of the Micronas family of value-optimized linear Hall sensors HAL 18xy. It is a universal magnetic field sensor with a linear analog output based on the Hall effect. The IC can be used for angle and linear measurements if combined with a rotating or moving magnet. The major characteristics like magnetic field range, sensitivity, offset (output voltage at zero magnetic field) and the temperature coefficients are programmable in a non-volatile memory.

The HAL 1820 is programmable by modulating the supply voltage of the sensor. No additional programming pin is needed. The easy programmability allows a 2-point calibration by adjusting the output signal directly to the input signal (like mechanical angle, distance or current). Individual adjustment of each sensor during the customer's manufacturing process is possible. With this calibration procedure, the tolerances of the sensor, the magnet and the mechanical positioning can be compensated in the final assembly.

This offers an alternative for all applications that presently need mechanical adjustment or laser trimming for calibrating the system. The sensor is designed to be used in automotive or industrial applications. It operates in a wide junction temperature range from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$.

The HAL 1820 is available in the very small leaded package TO92UA and in the small SMD package SOT89B.

Features

- Operates from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ junction temperature
- Linear Hall-effect sensor with ratiometric analog output
- Various programmable magnetic characteristics with non-volatile memory
- Digital signal processing
- Continuous measurement ranges from $\pm 20\text{ mT}$ to $\pm 160\text{ mT}$
- Temperature characteristics programmable for matching all common magnetic materials
- Programming via supply voltage
- Lock function and built-in redundancy for EEPROM memory
- Operates from 4.5 V up to 5.5 V supply voltage
- Operates with static magnetic fields and dynamic magnetic fields up to 1 kHz
- Overvoltage and reverse-voltage protection on V_{DD} pin
- Magnetic characteristics extremely robust against mechanical stress
- Short-circuit protected output

Functions

The HAL 1820 is the optimal system solution for functions such as:

- Linear movement

Generic Applications

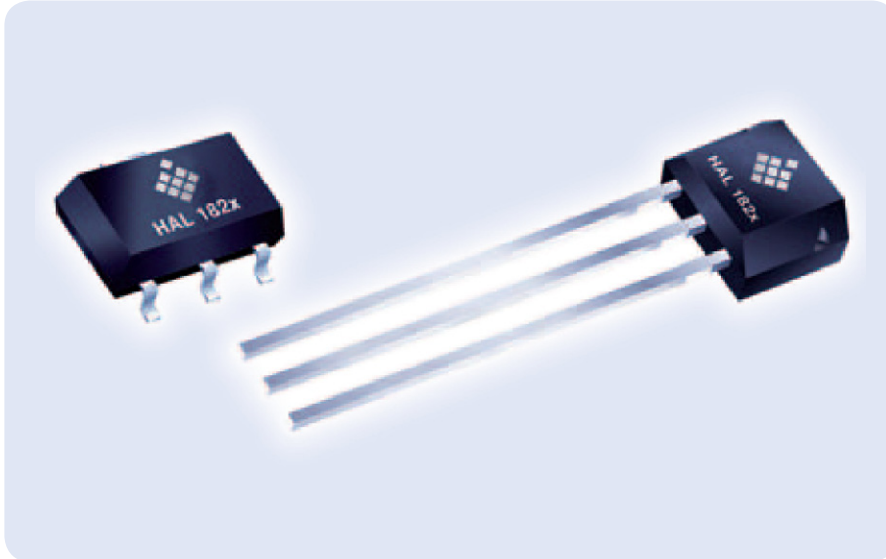
- Rotary position
- Leveling



HAL 182x

Hall-Effect Sensors

Value-Optimized Linear Hall-Effect Sensors with Fixed Sensitivity



The HAL 182x sub-family contains factory-set members of the Micronas family of value-optimized linear Hall sensors, offering excellent performance/price trade-off. They are universal magnetic field sensors with a ratiometric, linear analog output. The members of the sensor family can be used for magnetic field measurements, current measurements and detection of any mechanical movement. Very accurate angle measurements or distance measurements can also be carried out. The sensors are very robust and can be used in harsh electrical and mechanical environments. The output voltage is proportional to the magnetic flux density through the Hall plate. The chopped offset compensation leads to stable magnetic characteristics over supply voltage and temperature.

The different family members vary by sensitivity (25 mV/mT, 31.25 mV/mT, 29.4 mV/mT, and 50 mV/mT). The quiescent output voltage (offset) for all family members is 50% of the supply voltage. The sensors are designed for automotive and industrial applications and operate in the junction temperature range from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$.

The HAL 182x is available in the very small leaded package TO92UA and in the small SMD package SOT89B.



Features

- Operates from $-40\text{ }^{\circ}\text{C}$ up to $170\text{ }^{\circ}\text{C}$ junction temperature
- Linear Hall-effect sensor with ratiometric analog output
- Sensitivity:
 - HAL 1821: 50 mV/mT
 - HAL 1822: 31.25 mV/mT
 - HAL 1823: 25 mV/mT
- Temperature and stress stable quiescent output voltage
- Very accurate sensitivity and offset
- On-chip temperature compensation
- Active offset compensation
- Operates from 4.5 V up to 5.5 V supply voltage
- Operates with static magnetic fields and dynamic magnetic fields up to 1 kHz
- Overvoltage and reverse-voltage protection on V_{DD} pin
- Magnetic characteristics are extremely robust against mechanical stress.
- Short-circuit protected push-pull output
- EMC and ESD optimized designs

Functions

Due to the sensors' characteristics and their high accuracy, the HAL1821/1822/1823 are the optimal system solutions for applications such as:

- Linear movement
- Angle measurements
- Distance measurements
- Current measurements
- Magnetic field measurements

Generic Applications

- Rotary position
- Leveling

HAL 28x0, HAL 283x

Hall-Effect Sensors

Programmable Linear Hall-Effect Sensor Sub-Families with Digital Interfaces



The HAL 28x0, HAL 283x sub-families belong to a new generation of programmable linear Hall-effect sensors. They consist of members with different digital interfaces, including LIN, PWM and SENT (SAE J2716). The built-in RISC processor allows a fast implementation of new output formats or customer-specific signal processing. All members within this family can be programmed via LIN frames or Biphase-M telegrams depending on the family member. Additional programming pins are not needed.

Overall, the HAL 28xy family features a Hall plate with offset compensation technique and a precise temperature sensor, which is used for temperature compensation of both the Hall sensors' sensitivity and offset.

Signal processing is done by the internal RISC processor. This is of great benefit, because analog offsets, temperature shifts, and mechanical stress do not degrade the digital signals. Major characteristics like magnetic field range, sensitivity, offset and the temperature coefficients of sensitivity and offset can easily be adjusted to the magnetic circuit by programming the non-volatile memory.

The HAL 28x0, HAL 283x sub-families are available in the very small leaded package TO92UT.

Features

- Operating junction temperature range: -40 °C up to 170 °C
- High-precision linear Hall-effect sensor
- Spinning-current offset compensation
- Built-in temperature sensor
- Built-in RISC processor
- Digital signal processing
- Up to 16-bit resolution
- Customer-programmable temperature compensation of Hall sensitivity (2nd order) and Hall offset (1st order)
- Different interface options:
 - LIN 2.0 (HAL 2810)
 - SENT (HAL 283x)
 - PWM output up to 2 kHz (HAL 2850)
- Magnetic characteristics extremely robust against mechanical stress
- Non-volatile EEPROM with redundancy and lock function

Functions

Due to the sensors' versatile programming characteristics and low drifts, the HAL 28xy family is the optimal system solution for functions, such as:

- Linear movement
- Current measurement

Generic Applications

- Rotary position
- Leveling
- Force/pressure measurement
- Torque measurement



varioHAL[®]
by Micronas

HAL 28xy

Hall-Effect Sensors

Linear Hall-Effect Sensor Family with Digital Interfaces



The HAL 28xy family is a new generation of programmable Hall-effect sensors. It consists of members with different digital interfaces, like LIN, PWM, and SENT (SAE J2716). Due to its internal structure, it is possible to easily generate new family members. The built-in RISC processor allows a fast implementation of new output formats or customer-specific signal processing.

All members within this family can be programmed without any additional programming pin. Programming is done via LIN frames or BiPhase-M telegrams depending on the family member. Upon request, especially where in-system programming by the customer is not possible, pre-configured versions can be derived.

The HAL 28xy family features a Hall plate with spinning current offset compensation technique and a precise temperature sensor which is used for temperature compensation of both the Hall sensors' sensitivity and offset. The sensors' signal path is handled by the RISC processor. This is of great benefit because analog offsets, temperature shifts, and mechanical stress do not degrade the digital signals.

Major characteristics like magnetic field range, sensitivity, offset and the temperature coefficients of sensitivity and offset can easily be adjusted to the magnetic circuit by programming the non-volatile memory. Furthermore, the individual devices can also be obtained as pre-configured versions with defined settings as per customer requirements.

The HAL 28xy family is available in the very small leaded package TO-92UT.

Features

- Operating junction temperature range: –40 °C up to 170 °C
- High-precision linear Hall-effect sensor
- Spinning-current offset compensation
- Built-in temperature sensor
- Built-in RISC processor
- Digital signal processing
- Up to 12 bit resolution
- Customer-programmable temperature compensation of Hall sensitivity (2nd order) and Hall offset (1st order)
- Different interface options:
 - LIN2.0
 - SENT
 - PWM output up to 2 kHz
- Magnetic characteristics extremely robust against mechanical stress
- Non-volatile EEPROM with redundancy and lock function

Functions

Due to the sensors' versatile programming characteristics and low drifts, the HAL 28xy family is the optimal system solution for functions, such as:

- Linear movement
- Current measurement

Generic Applications

- Rotary position
- Leveling
- Force/pressure measurement
- Torque measurement



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by Micronas

HAL 36xy/38xy

Hall-Effect Sensors

Programmable Hall-Effect Sensor Families based on 3D HAL Technology



Features

- Operates from -40°C up to 170°C junction temperature
- Angular accuracy of better than $\pm 1^{\circ}$ over 360° range (HAL 36xy)
- Temperature drift $< \pm 1^{\circ}$ over entire temperature range
- Stable performance with air gap variation
- Output noise less than 0.2° rms
- Programming via output pin
- Wire-break detection with pull-up or pull-down resistor
- Lock function and built-in redundancy for EEPROM memory
- Operates from 4.5 V up to 5.5 V supply voltage
- Output response time $> 1\text{ ms}$
- Overvoltage and reverse-voltage protection on V_{DD} pin
- Short-circuit protected output

Functions

The HAL 3625 is the optimal system solution for functions such as:

- Angular measurement

The HAL 3855 is the optimal system solution for functions such as:

- Linear movement detection

Generic Applications

- Rotary position
- Leveling
- Torque sensing

The HAL 36xy/38xy families represent a new level of performance for Hall-effect sensors enabling a significant simplification in the design of magnetic systems. The sensors are based on Micronas' innovative 3D HAL technology, which combines standard lateral with vertical Hall plates. Whereas the HAL 36xy family is targeted for rotational movement detection up to 360° , the HAL 38xy targets extended linear movement detection up to 40 mm .

HAL 36xy: The devices of this family measure the X and Y component of a magnetic field in the sensor plane. Monitoring the relative strength of both components leads to a stable output even if the distance between magnet and sensor varies. The result is angular rotation measurement from 0° to 360° with very high accuracy over a wide temperature range. The first member of this family is the HAL 3625.

HAL 38xy: The devices of this family measure either the X or Y component in conjunction with the Z component of a magnetic field. Together with its 32-setpoint linearization feature, this family offers superior system performance for extended linear movement detection while using small magnet circuitry. The first member of this family is the HAL 3855.

The sensors are housed in a small SOIC8 SMD package, producing an analog, ratio-metric output. They include an integrated wire-break detection feature that works in conjunction with a pull-up or pull-down resistor to detect fault conditions. Internal digital signal processing algorithms in conjunction with integrated non-volatile memory enable customization and robust calibration for application-specific impairments. Easy to use LabVIEW™-based software and high-quality application notes accelerate development, even for novice magnet system designers. The result is a quickly developed, customized sensor system with extremely low temperature drift and insensitivity to air gap variations.

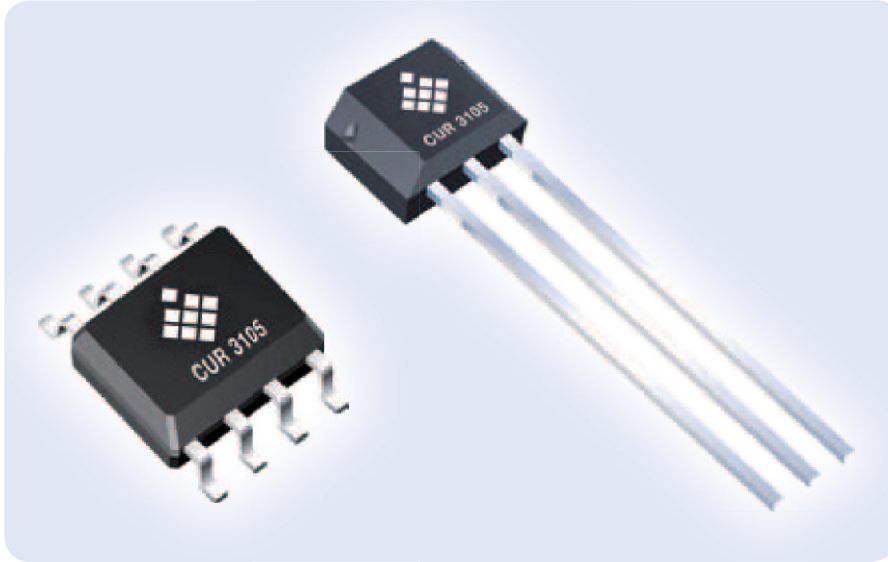


3D HAL®
by Micronas

CUR 3105

Current Sensors

Hall-Effect Current Transducers with Analog Output



The CUR 3105 represents the first member of the new Micronas product group of Hall-effect-based current transducers. It can be used for very precise current measurements. The output voltage is proportional to the measured current and the supply voltage (ratiometric analog output). Major characteristics, such as magnetic field range, sensitivity, output quiescent voltage (output voltage at $B=0$ mT) and output voltage range are programmable and are stored in the internal EEPROM.

The CUR 3105 features a temperature-compensated Hall plate with chopped off-set compensation, an A/D converter, digital signal processing, a D/A converter with output driver, an EEPROM memory with redundancy and lock function, a serial programming interface, and protection devices at all pins. The internal digital signal processing is of great benefit because analog offsets, temperature shifts and mechanical stress do not degrade the transducer's accuracy.

The CUR 3105 is programmable by modulating the supply voltage. No additional programming pin is needed. Individual adjustment of each transducer during the customer's manufacturing process is possible. With this calibration procedure, the tolerances of the IC and the mechanical positioning can be compensated in the final assembly.

The transducer is designed for automotive, white goods and industrial applications and operates with typically 5 V supply voltage in the wide junction temperature range from -40 °C up to 170 °C.

The CUR 3105 is available in the very small leaded package TO92UT and the SMD package SOIC8.

Features

- Operates from -40 °C up to 170 °C junction temperature
- High-precision current transducer with ratiometric output and digital signal processing
- Low output voltage drifts over temperature
12-bit analog output
- Multiple programmable magnetic characteristics in a non-volatile memory
- EEPROM with redundancy and lock function
- Open-circuit (ground and supply line break detection) with 5 k Ω pull-up and pull-down resistor, overvoltage and undervoltage detection
- For programming an individual transducer within several ICs in parallel to the same supply voltage, a selection can be done via the output pin
- Programmable clamping function
- Programming through modulation of the supply voltage
- Operates from 4.5 V up to 5.5 V supply voltage in specification and functions up to 8.5 V
- Operates with static magnetic fields and dynamic magnetic fields up to 1 kHz
- Overvoltage and reverse-voltage protection at all pins
- Magnetic characteristics extremely robust against mechanical stress
- Short-circuit protected push-pull output
- EMC and ESD optimized design

Generic Applications

Due to the sensor's versatile programming characteristics and low drifts, the CUR 3105 is the optimal system solution for contactless current measurement applications.



CUR 3150, CUR 3155

Current Sensors

Hall-Effect Current Transducers with PWM Output



CUR 315x is a current transducer sub-family based on the Hall effect. The IC can be used for very precise current measurements. The PWM output signal is proportional to the measured current. The CUR 315x family consists of the CUR 3150 and the CUR 3155. The CUR 3150 has a sensitivity drift accuracy over temperature of $\pm 3\%$ whereas the CUR 3155 offers a sensitivity drift accuracy of $\pm 1\%$.

Both ICs feature a PWM output with slewrate control, that enables a fast and robust data transfer in harsh environments. The PWM signal can be directly decoded by any unit measuring a duty cycle of a rectangular signal (usually a timer/capture unit in a microcontroller). The highest available PWM frequency is 2 kHz with 12-bit resolution. The PWM frequency is customer-programmable in a range between 31 Hz and 2 kHz, with a certain resolution. The open-drain output with programmable slew rates enables an excellent EMI performance of the total system.

The CUR 315x sub-family features a Hall-plate with spinning current offset compensation technique and a precise temperature sensor which is used for temperature compensation of both the Hall-sensors sensitivity and offset.

The sensor provides digital signal processing. This is of great benefit because analog offsets, temperature shifts, and mechanical stress do not degrade digital signals. Major characteristics, such as magnetic field range, sensitivity, offset, output polarity, clamping levels, and PWM frequency can easily be adjusted to the magnetic circuit by programming the non-volatile memory.

The CUR 315x sub-family is available in the very small leaded solderable or weldable package TO92UT.

Features

- Operating junction temperature range: $-40\text{ }^{\circ}\text{C} \dots 140\text{ }^{\circ}\text{C}$.
- High-precision current transducer
- Spinning-current offset compensation
- Built-in temperature sensor
- On-board diagnostics (overtemperature, overcurrent, etc.)
- Magnetic characteristics are extremely robust against mechanical stress.
- Digital signal processing
- Up to 16 bit resolution
- Sampling rate up to 2 kHz with internal low-pass filter
- Sample accurate transmission each PWM period transmits a new Hall sample)
- Programmable PWM frequency in a range between 31 Hz and 2 kHz
- Non-volatile EEPROM with redundancy and lock function
- Open-drain output with slew-rate control
Individual serial number for each transducer
- 12-bit customer serial number

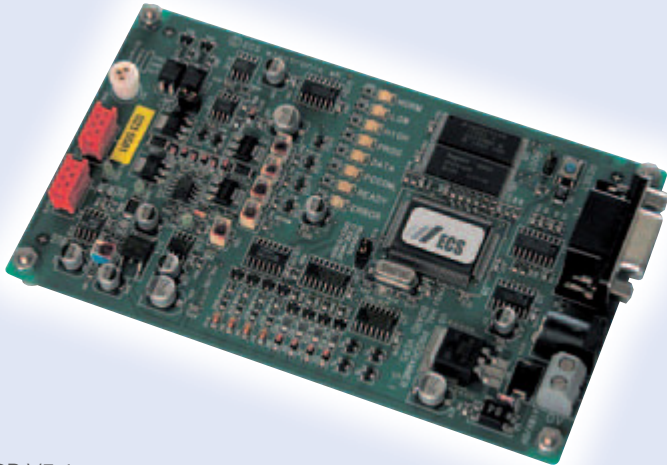
Generic Applications

Due to the sensor's versatile programming characteristics and low drifts, the CUR 315x is the optimal system solution for contactless current measurement applications.



Tool Chain for Hall-effect Sensors and Current Sensors

Hall-Effect Sensors



HAL APB V5.1



HAL APB V1.5

Micronas provides two dedicated programmer boards supporting all programmable sensors. These two programmer boards are used as a general-purpose programming interface, which is capable of addressing all programmable Micronas Hall-effect sensor families within the Micronas sensor portfolio.

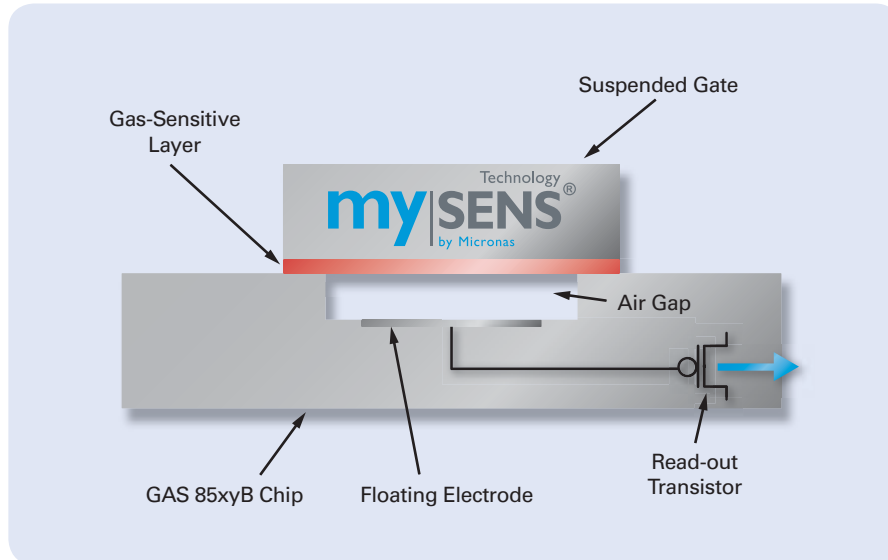
The application board V1.5 (APB) can be used for the new products HAL 1820, HAL 28xy, HAL 3625, HAL 3855, CUR 315x.

The application board V5.1 supports the following products: HAL 810, HAL 817, HAL 82x, HAL 85x, HAL 880, HAL 1000, and CUR 3105.

Both boards provide an application software supporting a command interface for the communication with a PC. This allows the implementation of specific PC software for engineering purposes or in-line calibration.

For each of the programmable Hall sensor families, a specific PC software exists. This software provides a graphical user interface based on Microsoft® Visual Basic® or LabVIEW™ values on a PC.

CCFET Gas Sensing Technology



Micronas CCFET sensor (Capacitive-Coupled Field-Effect Transistor) represents a new versatile integrated sensor technology. It aims at fast detection of concentration changes of selected ambient trace gases in a broad variety of different applications.

The sensor is based on a conventional MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor) with its floating gate connected to a large electrode. This electrode is capacitive coupled to a gas sensitive layer on a suspended gate which is mounted on top of the chip with an air gap in between. Any gas induced change of the sensitive layer's surface potential induces a modulation of the readout transistor that is detected by the integrated electronics.

The interaction between sensitive layer and ambient gas molecules is a dynamic physical process taking place at room temperature, allowing unheated low-power operation for many gas species.

The multi-parametric sensor platform GAS 85xyB includes two CCFET gas detection devices, a temperature sensor, a relative humidity sensor and electronic components, such as A/D converters, voltage and power regulators. Each sensor can be independently addressed via a digital serial peripheral interface (SPI). The set-up is optimized for drift reduction and temperature compensation, profiting from our design experience of advanced mixed signal semiconductor technology.

Micronas mySENS® sensor solution provides significant advantages in system size and power consumption. It can be individually tailored to a specific sensing task by choosing the appropriate sensitive layer for the suspended gate.

Technology

- Versatile, integrated digital gas sensor technology
- CCFET technology – gas detection based on physical effect
- No heating required for most target gas species
- Fast detection of concentration changes of ambient trace gases
- Adjustable detection spectrum (by sensing layer and algorithms)
- Fabrication process embedded into Micronas' CMOS manufacturing technology

Advantages

- System size and cost reduction by integrated solution with digital interface
- Multi-parametric detection with independent sensors for 2 gases, temperature and relative humidity
- Temperature and relative humidity sensors for compensation of gas sensor signals but also as measurement devices
- Integrated heating option
- Immunity against environmental interference, low cross sensitivities

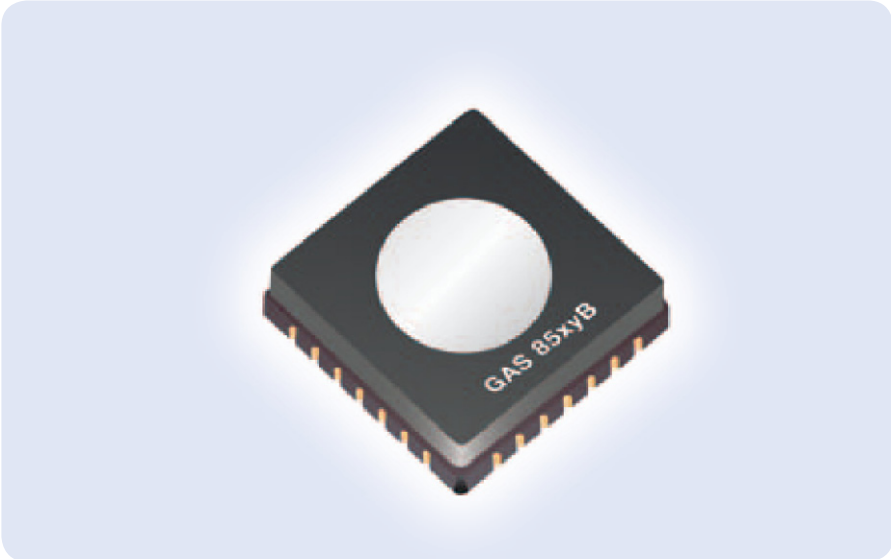
Information

- Explore mySENS® technology: <http://www.micronas.com/mySENS>
- For more information about Micronas gas sensors please email: mySENS@micronas.com

GAS 85xyB

Gas Sensors

Multi-Parametric Gas Sensor Platform with SPI-Output



The new GAS 85xyB is the first member of the Micronas family of multi-parametric ambient gas sensors based on our mySENS® CCFET (capacitive coupled field effect transistor) integrated gas sensing technology.

The sensor platform comprises two independent gas sensing devices plus a temperature sensor and a relative humidity sensor, all with integrated signal processing as well as digital output and control via SPI interface.

It can be used for detection of concentration changes of ambient trace gases in combination with measurement of temperature and relative humidity, providing solutions for specific target gases such as NO₂, NH₃, H₂, VOC and CO₂.

GAS 85xyB is available in a ceramic LCC28 package (approx. 11 mm x 11 mm) with plastic cap and Teflon® particle filter in following versions:



Features

- Operates from -40°C up to 85°C ambient temperature
- Two independent gas sensors
- Integrated temperature sensor
- Integrated relative humidity sensor
- Digital signal processing
- Digital SPI interface, directly addressable by common microcontrollers
- Measurement ranges from approx. 100 ppb to 1% gas concentration (exact values vary by target gas)
- Target gases NO₂, NH₃, H₂, VOC (volatile organic compounds) and CO₂
- Operates from 5% up to 95% relative humidity
- Low power consumption (unheated average operation <20µA)
- Long product life time (qualification acc. to JEDEC standard)

Functions

- The GAS 85xyB is the optimal system solution for:
- Detection of concentration changes of selected ambient gases
 - Upgrading temperature and relative humidity based applications with gas detection

Generic Applications

- Trace gas detection
- Ambient control

Application Examples

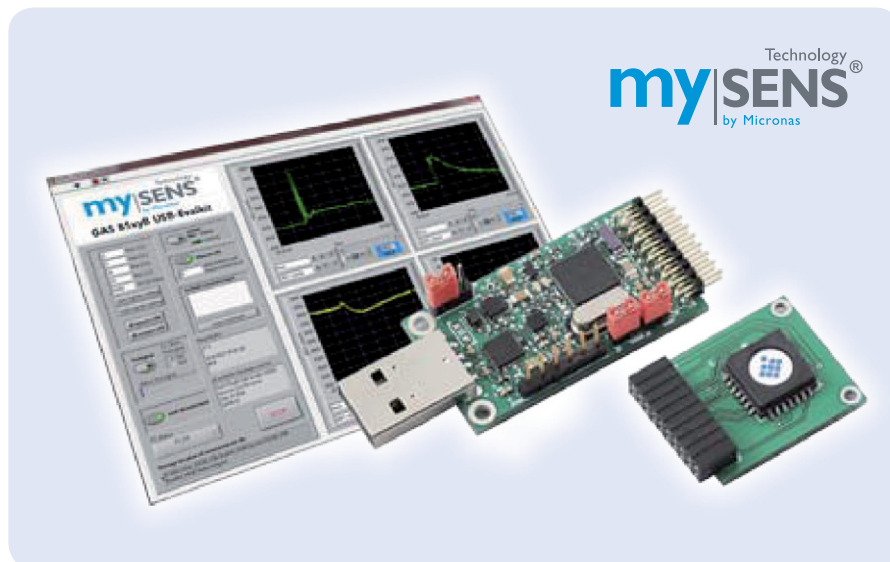
- Early fire detection
- Indoor / in-cabin air quality (AQS)
- Demand-controlled ventilation (DCV)
- Coolant leakage (NH₃ & CO₂)

Target gases	Product code
H ₂ + NH ₃	GAS 8514B
H ₂ + NO ₂	GAS 8516B
CO ₂ + NH ₃	GAS 8534B
NH ₃ + NO ₂	GAS 8546B
VOC	GAS 8555B

Tool Chain for GAS 85xyB Sensors

Gas Sensors

USB Evaluation Kit



Features

- Small form factor of 75mm x 24mm
- 5V power supply via USB
- Interface connector to connect different GAS 85xyB sensor modules
- Direct USB connectivity
- Microcontroller firmware SW update via USB
- Access to all GAS 85xyB sensor registers via LabVIEW™ GUI or direct control via HyperTerminal
- Running under Windows™ XP / 7

Advantages

- Easy to use
- No additional hardware required. One hardware for the entire GAS 85xyB product family
- Option for an autonomous data logger functionality with a battery and a micro-SD-card
- Pre-development of customer algorithms on a TI MSP430™ low-power microcontroller with its development tools
- Debugging interface. Additional SW tool-chain required (Compiler and JTAG HW-debugger)

Kit content

- USB microcontroller interface board
- Up to four GAS 85xyB sensor modules

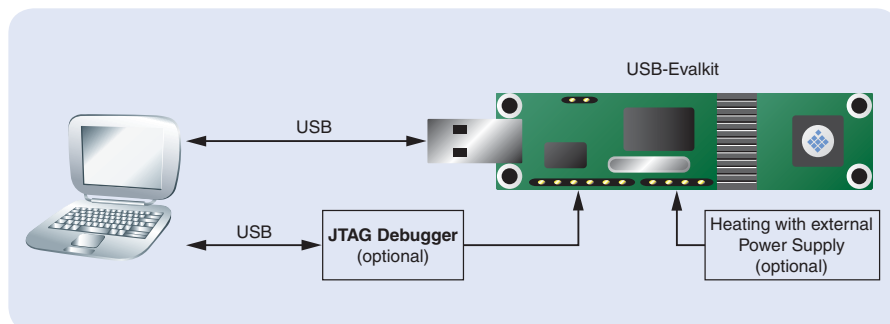
Application Support

- All required documentation, SW and drivers can be downloaded from the Micronas Service Portal: <https://service.micronas.com>
- For more information about Micronas USB evaluation kit please email to my: SENS@micronas.com

Micronas offers an evaluation kit with direct USB connectivity, supporting all available GAS 85xyB sensor versions without additional hardware. It is well suited for fast and uncomplicated evaluation of the mySENS® technology and further enables the development of user-specific prototype software and algorithms for user applications.

A Texas Instruments MSP430™ low-power microcontroller is employed to offer a range of possibilities for adapting all functionalities for all members of the GAS 85xyB sensor platform and for fulfilling low-power requirements.

With an executable LabVIEW™ graphic user interface customers are able to set up the complete GAS 85xyB sensor chip and to read out and store the measurement values on a PC.





The high-voltage microcontroller HVC 24xyB combines a standard microcontroller core with a wide range of additional functions which, up to now, could only be realized via external circuit elements.

The Micronas HVC 2480B, a high-voltage controller for use in automotive and industrial applications, features advanced integration for a compact and cost-effective system design.

Replacement of conventional mechanical drive by “on-demand” electric drive and a general adoption of more efficient electrical motors are the main reasons for a growing demand for cost effective system solutions for electrical motor control and drive. Long lifetime reliability, reduction of weight and overall dimension are additional key issues which have to be addressed especially for automotive applications like e.g. HVAC flaps. Thanks to their better efficiency, lower acoustic and electrical noise brushless DC (BLDC) are gaining a significant share of the electrical motors by replacing brushed (BDC) and stepper motors.

Micronas’ high-voltage controllers integrate almost all surrounding circuits needed for driving electrical motors. The built-in networking capabilities enable the deployment of LIN bus control for a wider range of applications like e.g. remote smart actuator. Reducing the number of external components to a minimum, the product’s flexible peripherals allow direct controlling of brushed and brushless electrical motors either by means of three fully integrated half-bridges or by controlling three external MOSFET half-bridges. Thanks to this flexibility in driving the electrical motor, HVC 24xyB controllers provide an effective system solution for both small and medium sized electrical motors, enabling a common product platform. This gives our customers a decisive competitive edge because they are much faster at the implementation stage and need fewer resources in the development process of their various applications.

HVC 2480B

Embedded Microcontrollers

High-Voltage Controller for Smart Actuators



The Micronas HVC 24xyB, a high-voltage controller family for use in automotive and industrial applications, features advanced integration for a compact and cost-effective system design.

Reducing the number of external components to a minimum, the product's flexible peripherals allow direct controlling of brush-type and brushless electrical motors either by means of three fully integrated half-bridges or by controlling three external MOSFET half-bridges. The chip provides an ideal solution for smart actuator and smart sensor applications. Three fully integrated half-bridges allow to directly connect a BLDC motor without the need for external components. Various integrated digital and analog circuit units such as comparators with virtual star point reference or embedded amplifier allow users to minimize the number of external components.

Beside timers/counters, interrupt controller, multichannel A/D converter and enhanced PWMs, this family contains a voltage regulator for direct 12 V supply and a LIN physical layer interface. This makes the system lighter in weight and saves important space within the application.



Features

- Temperature range up to 125 °C ambient
- Direct 12 V operation.
- Versions with up to 32 kbyte Flash and 1.75 kbyte RAM
- On-chip EEPROM and oscillators
- Integrated triple half-bridge driver stage and pre-drivers for external half-bridges
- Logic modules dedicated to control BLDC motors
- Three comparators with integrated virtual star point or external reference
- 10-bit queued ADC, with selectable reference and flexible start of conversion trigger
- Operational amplifier
- Three enhanced PWMs (EPWMs), edge/center-aligned with non-overlapping capability
- Configurable status of I/Os in reset
- Switchable 5 V power supply output
- SPI and enhanced LIN 2.x UART
- LIN 2.x transceiver
- Active EMI suppression hardware
- Supply & temperature supervision
- Power saving modes

Functions

The HVC 24xyB is the optimal system solution for controlling of brush and brushless motors, especially for small form factor applications

Generic Applications

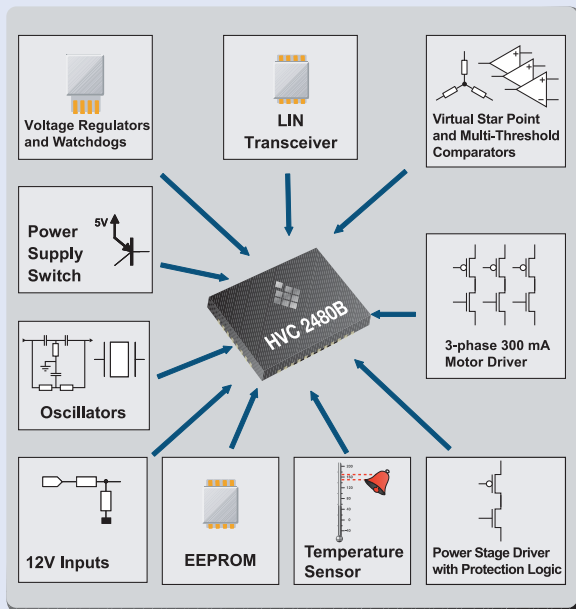
- Directly driving small motors
- Driving of motors with higher current via external half-bridges

Application Examples

- Closed-loop control of Pumps for fuel, oil, water, etc.
- Control of fans, e.g. for LED headlights
- Electrically controlled valves
- LIN controlled actuators

Functions

Embedded Microcontrollers

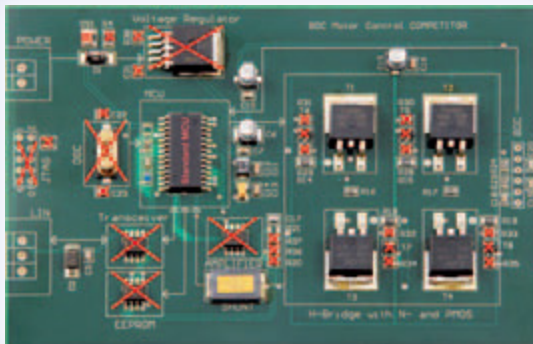


Features

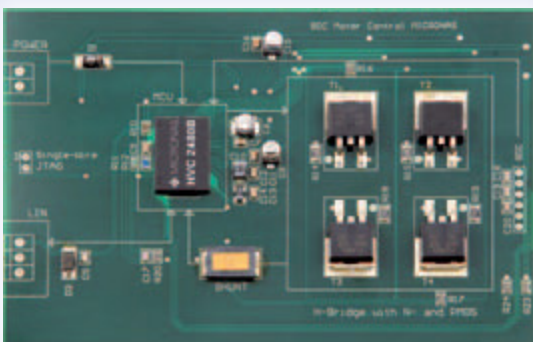
- High-performance 8-bit 8051 core (two-clock machine cycle) running with up to 24 MHz
- 1.75 Kbyte RAM
- 32 Kbyte Flash memory
- 512 Byte EEPROM
- On-chip oscillators and watchdogs
- Active EMI suppression module
- Triple half-bridge
- Drivers for up to three external half-bridges
- Three comparators with selectable reference: integrated virtual star point or external reference input
- Embedded operational amplifier
- 10-bit queued ADC, with down to 2.6 μ s conversion time, various triggers and references
- Temperature sensor
- Switchable 5 V supply
- LIN 2.x physical layer interface
- PQFN40 6x8 mm² package
- $T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

Target Applications

- Single-, two- or three-phase(s) BLDC motors in:
 - Fans
 - Pumps
 - Smart actuators
- Sensor or sensorless controlled operation
- Block or sinusoidal (space vector modulation) commutation
- Speed and current control



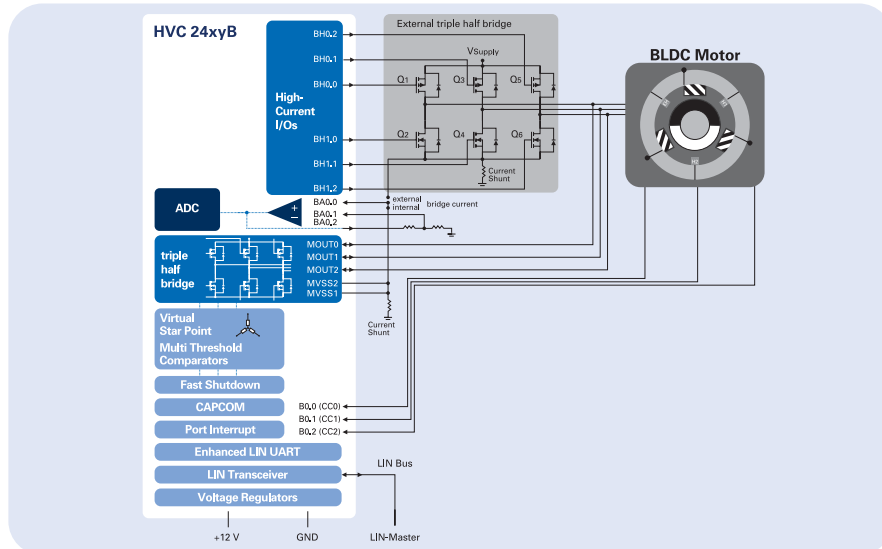
Application example: DC motor control conventional solution



Cost-effective solution with the HVC 2480B

Motor Control Applications

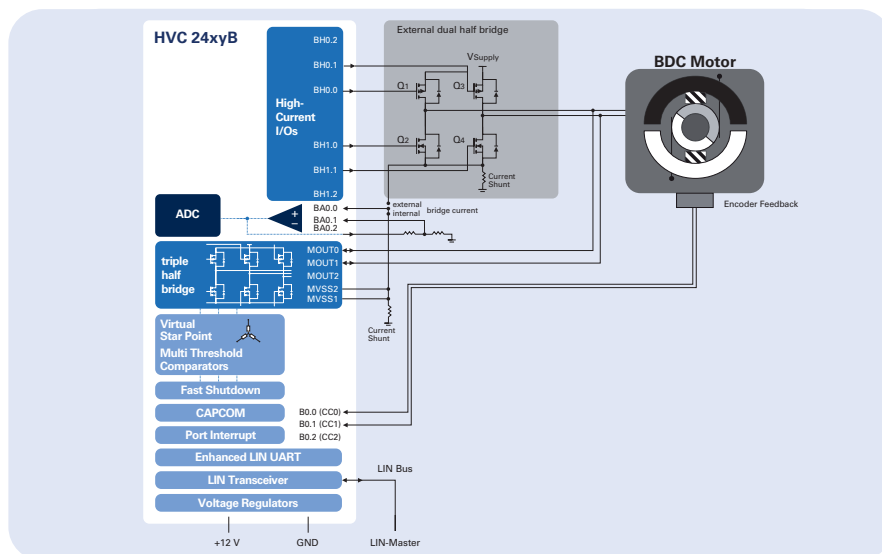
Embedded Microcontrollers



BLDC Motor Control

Sensor-Controlled Commutation

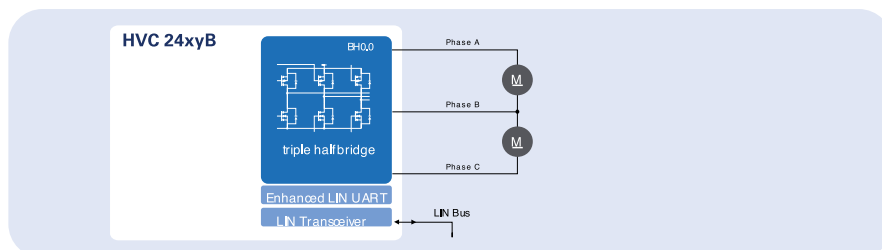
- The BLDC motor provides internal position monitoring with Hall sensors
- The sensor output can be fed back to the HVC and captured by its Capture/Compare Module "CAPCOM" modules (one input capture for each phase) to derive the information for commutation
- The Multi-threshold Comparator "MTC" and fast shutdown logic is used to protect the bridge



BDC Motor Control

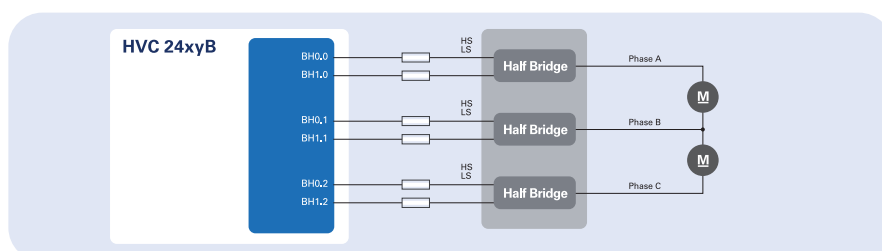
Brush-type DC Motor

- The PWM voltage outputs of the HVC control the motor current via the half-bridges
- The polarity of the half-bridges' output voltage define the direction of rotation
- Multi-Threshold Comparator "MTC" and fast shutdown logic integrated in the HVC protect the bridges



Side Mirror

- Triple half-bridge with 300 mA driving capability
- LIN transceiver



Window Lift and Door Lock

- The current feedback determines if the window motor is controlled in a safe mode
- An additional sensor feedback may be added to sensitize the circuitry (not shown in the diagram)
- With the integrated Multi-Threshold Comparator "MTC" the HVC verifies if the door lock is working in the predefined range

Tool Chain for Embedded Microcontrollers

Embedded Microcontrollers

Highly Integrated High-Voltage Controller with Integrated Half-Bridges

Micronas' high-voltage microcontroller HVC 24xyB for use in automotive and industrial applications features advanced integration for a compact and cost effective system design.

The controller contains voltage regulators for direct 12 V supply and a LIN 2.x compliant transceiver. Three internal transistor bridges or high-current output ports can be used to drive LEDs or external power-MOS devices directly. Three integrated half-bridges allow to control 3-phase BLDC motors directly.

The number of necessary bridges or external components is reduced to a minimum. Flexible integrated modules allow controlling DC motors – brush-type or brushless – via enhanced PWM outputs, monitoring a switch matrix or acting as a sensor interface. The chip provides an ideal solution for smart sensor and smart actuator applications.

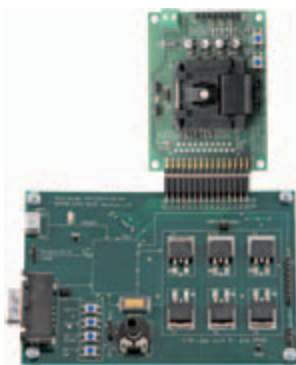
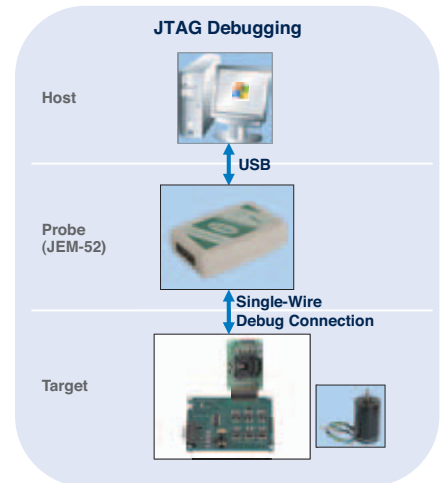
Development Tools

- JTAG Emulator (JEM) with single-wire debug interface
- Application boards
- SW packages with API and LIN driver
- Integrated development environment with debugger and compilers from several 3rd-party vendors

Application Boards

Special-purpose APBs (SPAPBs)

- For demonstrations and customer use
- For dedicated applications, e.g. BLDC/BDC H-bridge control
- Stand-alone use if equipped with HVC 24xyB
- Connector for HVC card or other PCBs



SPAB with HVC card for brushless DC motor control



SPAB with HVC card for brush-type DC motor control

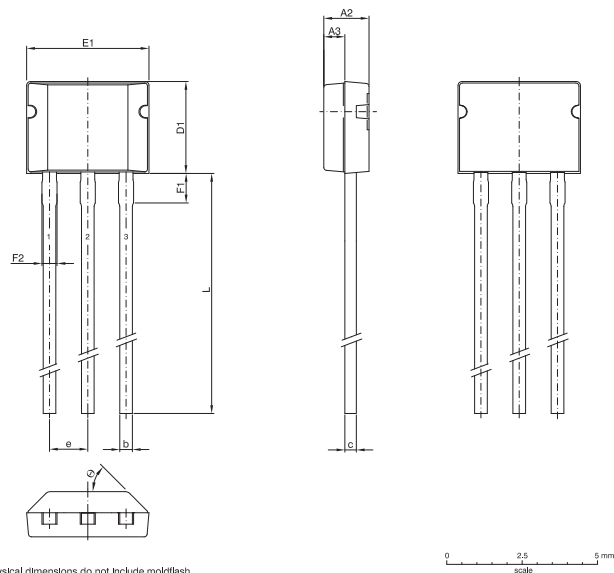


Small demo board for e.g. brushless or brush-type DC motor control and various interfaces as LIN, RS232, SPI, etc.

Package Outlines

Package Information

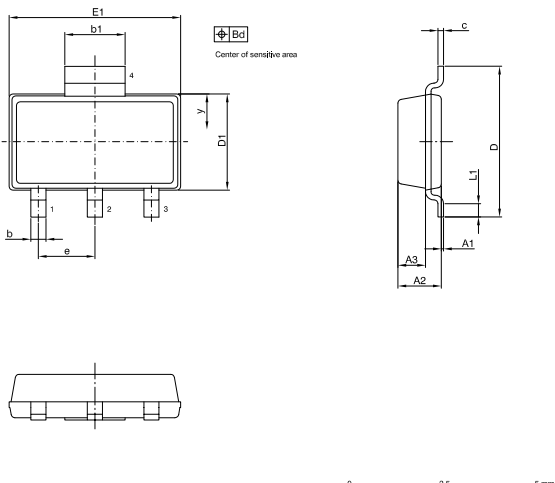
TO92



physical dimensions do not include moldflash.
solderability is guaranteed between end of pin and distance F1.
A4, y= these dimensions are different for each sensor type and is specified in the data sheet.
min/max of D1 are specified in the datasheet.

UNIT	A2	A3	b	Bd	c	D1	e	E1	F1	F2	L	θ
mm	1,55 1,45	0,7	0,42	0,2	0,36	3,05	1,27	4,11 4,01	1,2 0,8	0,60 0,42	15,5 min	45°

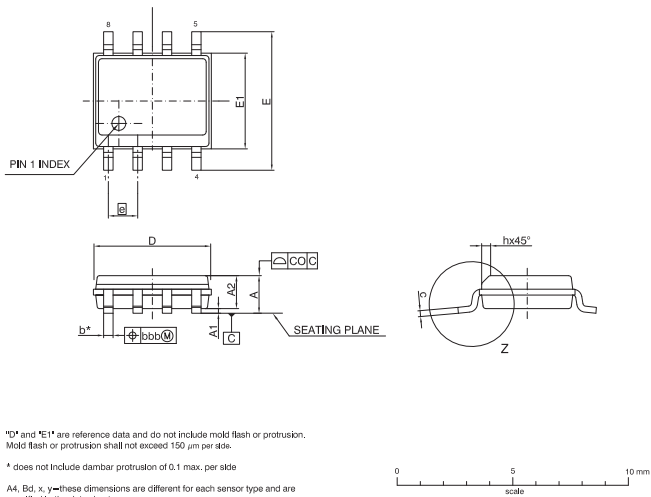
SOT89



physical dimensions do not include moldflash.
A4, y= these dimensions are different for each sensor type and are specified in the data sheet.

UNIT	A1	A2	A3	b	b1	Bd	c	D	D1	e	E1	L1
mm	0,10 0,02	1,20 1,10	0,73	0,4	1,7	0,2	0,15	4,0	2,6 2,5	1,5	4,6 4,5	0,25 min

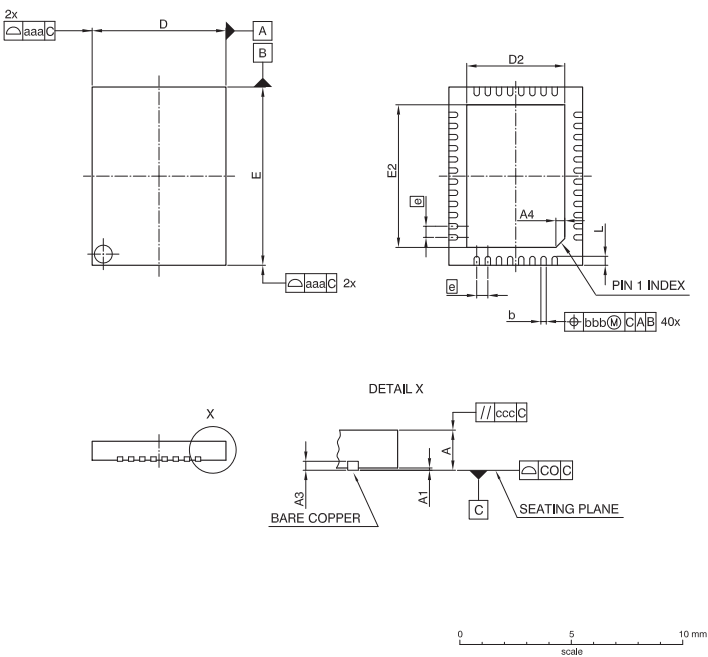
SOIC8



"D" and "E1" are reference data and do not include mold flash or protrusion.
Mold flash or protrusion shall not exceed 150 µm per side.
* does not include dambar protrusion of 0.1 max. per side
A4, Bd, x, y=these dimensions are different for each sensor type and are specified in the data sheet

UNIT	A	A1	A2	b	bbb	c	CO	D	E	E1	e	h	L	θ
mm	1,65	0,25 0,1	1,45	0,4	0,25	0,22	0,1	5,0 4,8	6,0	4,0 3,8	1,27	0,3	0,41 min.	8° max.

QFN40



UNIT	A	A1	A3	A4	aaa	b	bbb	ccc	CO	D	D2	E	E2	e	L
mm	1,0 0,8	0,05 0,0	0,2	0,4x45°	0,15	0,3 0,18	0,1	0,1	0,08	6,0	4,2	8,0	6,2	0,5	0,3

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