Hall-Effect Switches

Selection Guide for Automotive and Industrial Applications

公TDK

❖ MICRONAS
5 Billion
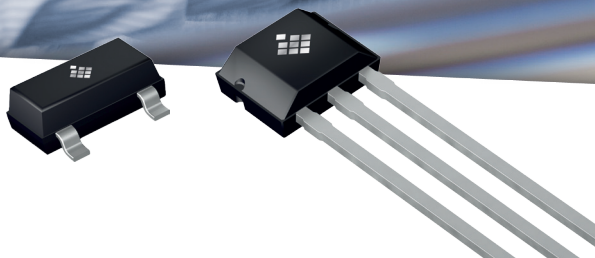Sensors shipped

BLDC   HALL   POSITION

Selection by Application – Automotive

	Recommended Solution	Comment
BLDC Motor Commutation	HAL 15xy 3-wire latching e.g. HAL 1502, HAL 1501	– High temperature resistance up to 150 °C (TA) – Low current consumption of only 1.6 mA – High switching accuracy – Small SOT23 JEDEC package
Clutch and Brake Pedal Position Detection	Brake: HAL 15xy 2-wire unipolar e.g. HAL 1564 Clutch: HAL 15xy 3-wire unipolar e.g. HAL 1503, HAL 1508	– ISO 26262 compliant for safety critical applications – High ESD protection ±8 kV (HBM) – Provided with open drain output or with current interface
Gear Shift Lever	HAL 15xy 3-wire unipolar e.g. HAL 1507	– Price-attractive solution to provide actual position of the gear shift lever with two sensors – Small SOT23 JEDEC package – ISO 26262 compliance for safety-critical applications
Window Lifter	HAL 15xy 3-wire or 2-wire latching e.g. HAL 1502, HAL 1501	HAL 15xy single Hall plate switches: – Price-attractive solution – High threshold accuracy thanks to lowest output jitter – ISO 26262 compliance for safety critical applications Explanation: HAL 15xy counts the motor revolutions while the motors' motion direction is determined by the control unit. Software algorithms help to specify the accuracy of the motion direction.
Seat Track Position	HAL 15xy 2-wire unipolar e.g. HAL 1563, HAL 1566	– ISO 26262 compliance for safety-critical applications – Power supply down to 2.7 V – ESD protection ±8 kV (HBM) – 2-wire IC allows to skip one wire
Seat Belt Presence Detection	HAL 15xy 2-wire unipolar or latching e.g. HAL 1566, HAL 1562	– ISO 26262 compliant for safety-critical applications – Power supply down to 2.7 V – ESD protection ±8 kV (HBM) – 2-wire IC allows to skip one wire

Selection by Application – Industrial

	Recommended Solution	Comment
BLDC Motor Commutation	HAL 1502 or HAL 1501	These Hall switches in SOT23 packages offer high switching accuracy and low power consumption and are used for the commutation of brushless DC motors e.g. in power tools, washing machines, dish washers, ventilation fans or electric bikes.
Rotation and Speed Sensor	HAL 15xy	The HAL 15xy switch family enable short output switching time and is used to detect or to control the speed of motors, fans or liquid flow, e.g. in power tools, home appliances, white goods (water delivery) and wheel-speed in electric vehicles and electric bikes.
Proximity and Position Sensor	HAL 15xy	The HAL 15xy switch family is offered in small packages and enable accurate switching points and a short output refresh time. They are used as proximity sensors to detect the end-position to stop the motor or to detect the absence or presence of material, e.g. rolling shutter, or doors, or factory automation.
Position and Rotation Sensor with 2 wires	HAL 1565, HAL 1564	These 2-wire Hall switches for wire saving with high switching accuracy, low power consumption and integrated wire-break detection can be used to detect e.g. if the door is closed or open.

Selection of Hall-Effect Switch Type

Variant		Magnetic Characteristics Typical @ 25 °C		Type				Typical Temperature Coefficient			
		B_{ON} – [mT]	B_{OFF} – [mT]	Unipolar	Unipolar Inverted	Bipolar	Latching	0 ppm/K	–300 ppm/K	–1000 ppm/K	–1200 ppm/K
HAL 10xy[3]	HAL 1002	Programmable		●	●		●	Programmable[5]			
HAL 15xy[3,4]	HAL 1501	0.4	–0.4			●		●			
	HAL 1502	2.5	–2.5				●			●	
	HAL 1503	5.5	3.7	●						●	
	HAL 1504	7.6	–7.6				●				●
	HAL 1505	13.5	–13.5				●				●
	HAL 1506	18.9	17.3	●							●
	HAL 1507	28.2	23.9	●					●		
	HAL 1508[6]	–5.5	–3.7	●						●	
	HAL 1509	3.7	5.5		●					●	
	HAL 1510	12	7	●							●
	HAL 1561	4	–4				●	●			
	HAL 1562	12	–12				●	●			
	HAL 1563	7.6	9.4		●			●			
	HAL 1564	4.1	6		●					●	
	HAL 1565	6	4.1	●						●	
	HAL 1566	9.4	7.6	●				●			

[1] straight or spread leads

[2] standard 15.7 ± 0.2 mm or long lead length 21 ± 0.2 mm

[3] T_J = -40 °C to 170 °C
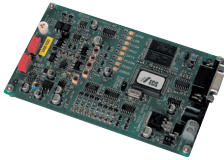
[4] ISO 26262 compliant

[5] from 0 to -2000 ppm/K

[6] north pole sensitive

Configuration		Package			Current Consumption					Supply Voltage			Application Range		
2-Wire	3-Wire	SOT23	TO92UA[1,2]	TO-92UT	I_{SUP} = 1.6 mA	I_{SUP} = 7 mA	$I_{SUPlow1}$ = 2...5 mA	$I_{SUPlow2}$ = 5...7 mA	$I_{SUPIhigh}$ = 12...17 mA	V_{SUP} = 2.7...24 V	V_{SUP} = 3...24 V	V_{SUP} = 4.5 V... 8.5 V	Position Detection	RPM Measurement	Brushless DC Motor
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Development Tool

	HAL APB 5.1
	Application & Programming Board
	Supported Sensors:
	HAL 10xy
	Stand-alone Tool

Technical Definitions

	2-Wire Switch	3-Wire Switch
Unipolar	The switch turns to high current consumption with the magnetic south pole on the top side of the package and turns to low consumption if the magnetic field is removed. The switch does not respond to the magnetic north pole on the top side.	The output turns low with the magnetic south pole on the top side of the package and turns high if the magnetic field is removed. The switch does not respond to the magnetic north pole on the top side.
Unipolar Inverted	The switch turns to low current consumption with the magnetic south pole on the top side of the package and turns to high consumption if the magnetic field is removed. The switch does not respond to the magnetic north pole on the top side.	The output turns high with the magnetic south pole on the top side of the package and turns low if the magnetic field is removed. The switch does not respond to the magnetic north pole on the top side.
Bipolar	(3-wire only)	The output turns low with the magnetic south pole on the top side of the package and turns high with the magnetic north pole on the top side. The output state is not defined if the magnetic field is removed again.
Latching	The switch turns to high current consumption with the magnetic south pole on the top side of the package and turns to low consumption with the magnetic north pole on the top side. The current consumption does not change if the magnetic field is removed. For changing the current consumption, the opposite magnetic field polarity must be applied.	The output turns low with the magnetic south pole on the top side of the package and turns high with the magnetic north pole on the top side. The output does not change if the magnetic field is removed. For changing the output state, the opposite magnetic field polarity must be applied.

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

Packages

Package	Marking Code	MOQ / MSQ Quantity			Package Drawing	RoHS compliant
		Reel	Ammopack 1), 2)	Bulk 2)		
TO92UA	UA, JQ	–	2,000	2,000		Yes
TO92UT	UT	–	2,000	2,000		Yes
SOT23	SU	20,000	–	–		Yes

For additional information please read or ask for our documentation "Sensors and Controllers: Ordering Codes, Packaging, Handling"

1) Pin configuration inline, spread
2) Pin configuration inline, not spread

TDK-Micronas Contact

Contact	Information available
www.micronas.tdk.com	General
www.service.micronas.com (registration needed)	Data sheets, application notes, programming guides, software…
product.support@micronas.com	Technical support

TDK-Micronas Company Profile

TDK-Micronas is the center of competence for magnetic-field sensors and CMOS integration within the TDK group. TDK-Micronas has gained operational excellence for sensors and actuators production in over 25 years of in-house manufacturing. It has been the first company to integrate a Hall-effect based sensor into CMOS technology in 1993. Since then, TDK-Micronas has shipped over five billion Hall sensors to the automotive and industrial market. The operational headquarters are located in Freiburg im Breisgau (Germany). Currently, TDK-Micronas employs around 1,000 people.
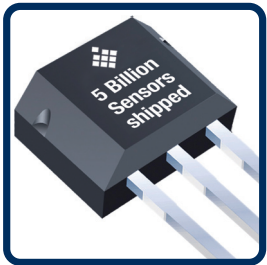
Global Presence

● Production + R&D   ● Marketing, Sales, FAE

Design-Centers

Freiburg – Germany
Munich – Germany

Production Site

Freiburg – Germany