



Selection Guide for Automotive Applications

Linear and Multi-Axis Hall-Effect Sensors



Micronas Company Profile

Micronas (SIX Swiss Exchange: MASN) is known and recognized in the automotive and industrial business as a reliable global acting partner for intelligent, sensor-based system solutions. Micronas offers a variety of Hall sensors and embedded controllers for smart actuators for automotive and industrial applications, such as drive trains, chassis frames, engine management and convenience functions.

Micronas serves all major automotive electronics customers worldwide, many of them in continuous partnerships seeking joint success. While the holding company is headquartered in Zurich (Switzerland), operational headquarters are based in Freiburg (Germany). Currently, the Micronas Group employs around 900 persons.

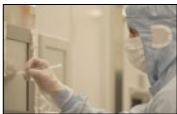
- 3 billion HAL sensors shipped
- No. 1 supplier of linear Hall sensors (IHS 2013)



Global Presence



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



Design-Centers

Freiburg – Germany
Munich – Germany

Production Sites

Freiburg – Germany



Glenrothes – UK



Package	Marking Code	MOQ / MSQ Quantity			Package Drawing	RoHS compliant
		Reel	Ammopack ^{1), 2)}	Bulk ²⁾		
SOIC8	DJ	7000	–	–		Yes
TO92UA	UA	–	2000	2000		Yes
TO92UP	UP	–	2000	–		Yes
TO92UT	UT	–	2000	2000		Yes
SOT89	SF	2000	–	–		Yes
For additional information please read or ask for our documentation „Hall Sensors Ordering Codes, Packaging, Handling“						
¹⁾ Pin configuration inline, spread ²⁾ Pin configuration inline, not spread						

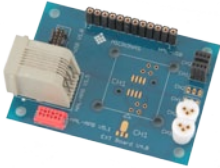
Micronas Contact

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

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Development Tools

	HAL APB 1.5 Application & Programming Board Supported Sensors: HAL 1820 HAL 36xy HAL 37xy HAL 38xy HAL 28xy HAL 242x in combination with Extension Board v.4.0
	HAL APB 5.1 Application & Programming Board Supported Sensors: HAL 8xy standalone tool
	HAL USB Programming Tool v.1.0 Supported Sensors: HAL 1820 HAL 24xy HAL 3625 HAL 3675 HAL 37xy HAL 385x HAL 387x in combination with Extension Board v.4.0
	Micronas Extension Board v.4.0 Connectable Sensor Packages: TO-92 (3-pin) package TO-92UP (4-pin) package SOT-89 (4-pin) package SOIC-8 (8-pin) package Connectable Programming Tools: HAL-APB V1.x Programmer Board HAL USB-Kit

1. Selection by Application

		Recommended Solution	Comment	Alternative
Accelerator Pedal		HAL 835	Smallest error by pedal idle position (0°)	HAL 3725
Adaptive Frontlight System		HAL 835	High immunity against temperature variation	–
Adaptive Suspension System / Chassis Position		HAL 3715	Flexible and easy assembly thanks to Modulo 90 feature	HAL 2850
Brake Pedal Position		HAL 2455	Smallest error for small angles or linear movement / with digital output / version with redundancy function available soon	HAL 3736/ HAL 3737
Clutch Cylinder		HAL 37xy	Application requires measurement of 40 mm movement, highest accuracy achievable with HAL 37xy	HAL 855
EGR / Cut-Off Valve / Waste Gate Actuator		HAL 37xy	1 % full-scale error required by application	HAL 835
Fuel Level Detection		HAL 835	Price-sensitive application & analog output standard interface for this application	HAL 3725
Gear Shift Selector		HAL 37xy	Usual angular range is above 120°, highest accuracy achievable with HAL 37xy	HAL 2425
Steering Angle		HAL 3735	360° application & digital output	–
Steering Torque		HAL 283x	Small-angle application & SENT protocol / version with redundancy function available soon	–
Throttle Position		HAL 37xy	Highest angle accuracy for 120° & simple magnetic circuit	HAL 83x
Transmission	Neutral Detection Sensor	HAL 835	High temperature stability and output signal flexibility (analog and PWM)	HAL 24xy
	Dual-Clutch Transmission Position with Integrated ECU	HAL 18xy	All compensation (sensitivity / offset, etc.) will be done by ECU software. Low-end linear sensor is required.	HAL 83x
	Dual-Clutch Transmission Position without Integrated ECU	HAL 373x	Application requires measurement of 40 mm movement, highest accuracy achievable with HAL 37xy	HAL 387x
	Transmission Range Sensor	HAL 373x	Application requires measurement of 40 mm movement, highest accuracy achievable with HAL 37xy	HAL 387x
Neutral Gear Position		HAL 373x	2D required, because usual detection angle is >180°. Next step will be full gear detection.	HAL 835
Turbo Charger Actuator		HAL 37xy	1 % full-scale error required by application	HAL 835

2. Selection of Sensor Type ($\tau_j = -40 \dots 170 \text{ }^\circ\text{C}$)

Product Family	Product Type	Field Component	Measurement					Package	
			Linear	Angular			Leaded	SMD	
				End of Shaft	Off-Axis				
					up to 60°	up to 180°			up to 360°
HAL 8xy	HAL 830	Z	●	●	●			TO92UT	
	HAL 835	Z	●		●				
	HAL 85x ¹⁾	Z	●			●			
HAL 18xy	HAL 1820	Z	●		●			TO92UA	SOT89
HAL 24xy	HAL 2420	Z	●		●			TO92UT	SOIC8
	HAL 2425	Z	●			●			
	HAL 2455	Z	●			●			
HAL 28xy	HAL 283x	Z	●		●			TO92UT	
	HAL 2850	Z	●		●				
HAL 36xy	HAL 3625	X-Y		●				TO92UP	SOIC8
	HAL 3675	X-Y		●					
HAL 37xy	HAL 3725	X-Y		●				TO92UP	SOIC8
	HAL 3726	Y-Z	●				●		
	HAL 3727	X-Z	●				●		
	HAL 3735	X-Y		●					
	HAL 3736	Y-Z	●				●		
	HAL 3737	X-Z	●				●		
HAL 38xy	HAL 3855	Y-Z	●				●	TO92UP	SOIC8
	HAL 3856	X-Z	●				●		
	HAL 3875	Y-Z	●				●		
	HAL 3876	X-Z	●				●		

¹⁾ 2-wire version available

License Note

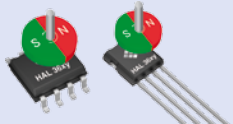
HAL 36xy/38xy use licenses of Fraunhofer Institute for Integrated Circuits IIS.

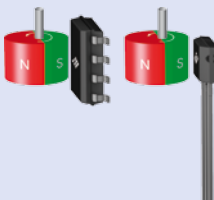
Output			Setpoints	Error at Full Temperature Range			Reso- lution	Response Time
Analog	PWM	Sent SAE J 2716 V 2010		Min.	Max.	Remark		Typ.
●			2	−4%	4%	2)	12 bit	0.9 ms
●	●		2	−1%	1%	2)		
	●		32	−1%	1%	2)	12 bit	0.9 ms
●			2	−6%	6%	2)	10 bit	0.5 ms
●			2	−1%	1%	2)	12 bit	0.5 ms
●			16					
	●		16					
		●	2	−1%	1%	2)	12 bit	N/A
	●		2				up to 16 bit	N/A
●			32	−2.6°	2.6°	3)	up to 12 bit	0.5 ms
	●		32					
●			33	−1.8°	1.8°	3)	up to 12 bit	0.5 ms
●			33					
●			33					
	●	●	33					
	●	●	33					
	●	●	33					
●			32	−2.6°	2.6°	3)	up to 12 bit	0.5 ms
●			32					
	●		32					
	●		32					

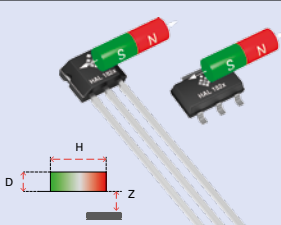
²⁾ Error in magnetic sensitivity

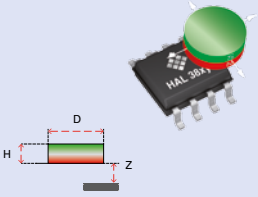
³⁾ Angle error after CORDIC, valid for ideal sine and cosine magnetic components

3. Selection of Magnet

End of Shaft	Type	Direct Angle 360°
	HAL 36xy HAL 3725 HAL 3735	D=10, H=2.5, Z=4 NL <±0.25% RT

Off-Axis	Type	Angle	Magnet
	HAL 8xy	<70°	D=15, H=6, Z=2.5 NL <±1% RT
	HAL 24xy	<180°	D=15, H=6, Z=2.5 NL <±0.15% RT
	HAL 38xy HAL 37x6 HAL 37x7	360°	D=15, H=6, Z=2.5 NL <±0.15% RT

Parallel	Type	12 mm Distance	20 mm Distance	40 mm Distance
	HAL 8xy	D=8, H=26, Z=4 NL <±1% RT	D=8, H=43, Z=4 NL <±1% RT	D=8, H=86, Z=4 NL <±1% RT
	HAL 24xy	D=8, H=12, Z=4 NL <±0.15% RT	D=8, H=20, Z=4 NL <±0.15% RT	D=8, H=40, Z=4 NL <±0.15% RT
	HAL 38xy HAL 37x6 HAL 37x7	D=6, H=4, Z=4 NL <±0.15% RT	D=12, H=4, Z=4 NL <±0.15% RT	D=16, H=8, Z=4 NL <±0.15% RT

Orthogonal	Type	12 mm Distance	20 mm Distance	40 mm Distance
	HAL 8xy	D=31, H=6, Z=4 NL <±1% RT	D=52, H=6, Z=4 NL <±1% RT	D=103, H=6, Z=4 NL <±1% RT
	HAL 24xy	D=12, H=6, Z=4 NL <±0.2% RT	D=20, H=6, Z=4 NL <±0.2% RT	D=40, H=6, Z=4 NL <±0.2% RT
	HAL 38xy HAL 37x6 HAL 37x7	D=6, H=3, Z=4 NL <±0.2% RT	D=10, H=4, Z=4 NL <±0.2% RT	D=25, H=6, Z=4 NL <±0.2% RT

Magnets SmCo, NeFeB, AlNiCo – Br = 900...1300 mT

All dimensions are given in mm.

D: Diameter, H: Height, Z: Distance between magnet and the Hall sensor,
NL: Non-Linearity, RT: Room Temperature