

iC-MH 12-BIT HALL ENCODER



The iC-MH is an integrated Hall encoder for sensing the angular shaft position using a diametral magnet. With the internal signal processing, sine and cosine outputs of the Hall elements are used for the angle determination. The resolution can be programmed almost freely up to a maximum of 4096 angle steps per revolution.

Quadrature encoder signals of up to 2 MHz are available at the incremental outputs consisting of the pins A, B and Z. Mechanical input frequencies of 120 000 rpm are possible at the highest interpolation resolution of 12 bit. The position of the index pulse Z is adjustable. For block commutation, the pins U, V and W provide three output signals with 120° phase shift each. The starting angle is freely definable over a revolution. EC motors with 1 or 2 pole pairs can be operated. The incremental and commutation outputs are RS422 compatible and can be adjusted regarding the output drive current and slew rate.

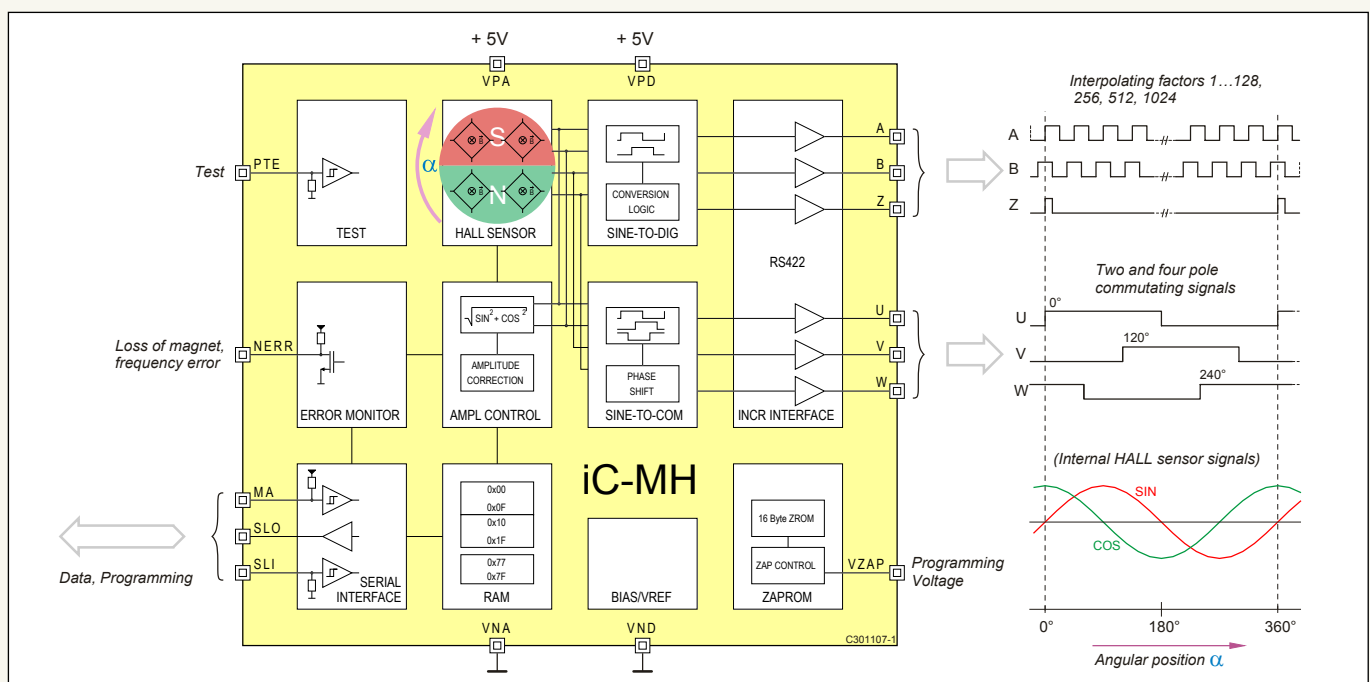
Using the serial interface angular position data can be transmitted and also access to the internal memory of iC-MH is possible. The chip configuration can then be stored permanently in a zapping diode based on-chip ROM.

Features

- Hall sensor array with automated signal conditioning
- Programmable fine offset correction
- Real-time no-missing-code interpolation to 12 bit: selectable factors $\times 1$ to $\times 128$, $\times 256$, $\times 512$, $\times 1024$
- Selectable hysteresis, min. edge distance, sense of rotation
- Quadrature encoder output signals to 2 MHz
- RS422-compatible differential or single-ended outputs
- Independent zero positions for ABZ and UVW
- Non volatile device setup by Zener diode zapping
- OEM data section for electronic signature
- Serial interface for fast data output (10 Mbit/s, SSI compatibility) and configuration setup
- Alarm indication with loss of magnet, excessive RPM speed

Applications

- Electronic commutation of brushless motors
- Contactless rotary switch / encoder
- Absolute and incremental rotary encoders





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Key Specifications

General	
Supply Voltage	5 V +/- 10 %
Supply Current, normal mode	20 mA max.
power reduction mode	10 mA max.
Max. Rotation Speed	120,000 rpm
Magnetic Field Strength	20 ... 100 kA/m
Resolution (digital / angular)	12 bit / 0.087°
Operational Temperature Range	-40 to +125 °C
ESD Susceptibility	2 kV (HBM 100 pF, 1.5 kΩ)

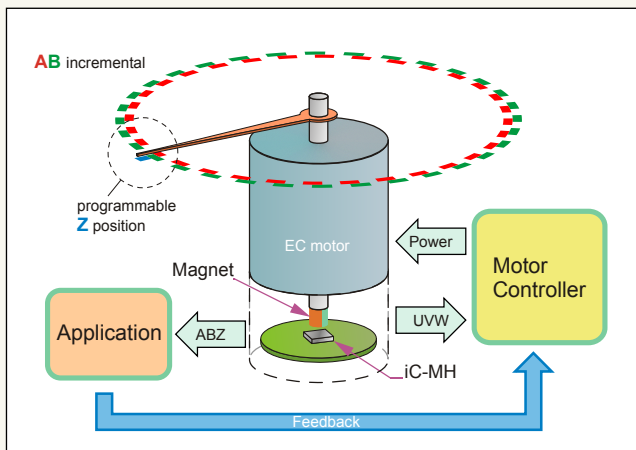
Operating Modes	
Output Modes	ABZ and UVW ABZ and inverted ABZ UVW and inverted UVW ABZ and AB period signals
Interpolation Factors	x1...x128, x256, x512, x1024 @ A, B
Commutation Signals UVW	two and four pole EC motors

Output Driver Settings	
Drive Modes	push-pull (RS422), high-side, low-side, tristate
Driving Capability (driving current, rise/fall time, frequency)	+/- 4 mA, 12 ns, 10 MHz +/- 60 mA, 12 ns, 10 MHz +/- 60 mA, 200 ns, 300 kHz +/- 20 mA, 20 ns, 3 MHz

Signal Conditioning	
Hall Signal Level	controlled to 2 Vpp
Coarse Gain Selection	x5, x10, x15, x20
Fine Gain (AGC range)	x1...x19 (64 steps)
Sin/Cos Amplitude Ratio	0.91 ... 1.097 (128 steps)
Offset Correction Range	+/- 63 mV in steps of 1 mV
Hysteresis ABZ	0.17°, 0.35°, 0.7° and 1.4°
Zero Position ABZ	adjustable in increments of 1.4°
Zero Position UVW	adjustable in increments of 1.875°

Serial Interface Output	
SSI Mode	data output to 2 MHz, 13 bit format
SSI (adv.)	10 MHz, register access, CRC

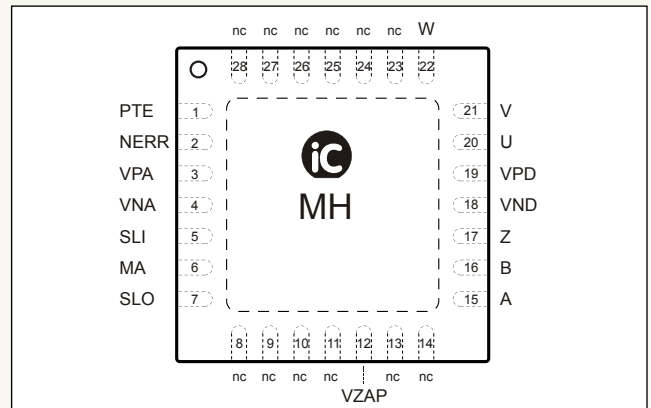
Application Example



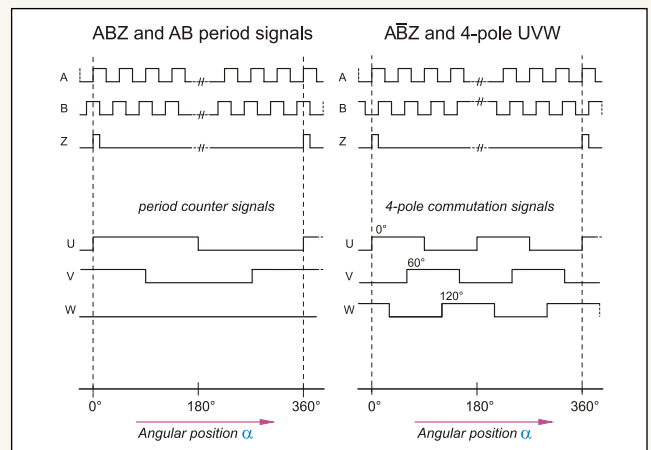
Pin Functions

No.	Name	Function
1	PTE	Test Enable Pin
2	NERR	Open Drain Error Output (low active)
3	VPA	+5 V Analog Supply Voltage
4	VNA	Analog Ground
5	SLI	Serial interface, Data Input
6	MA	Serial interface, Clock Input
7	SLO	Serial interface, Data Output
8 - 11	n.c.	-
12	VZAP	Zener Zapping Programming Voltage
13 - 14	n.c.	-
15	A (NU)	Incremental Output A
16	B (NV)	Incremental Output B
17	Z (NW)	Incremental Index Output Z
18	VND	Digital Ground
19	VPD	+5 V Digital Supply Voltage
20	U (NA)	Commutation Output U (0°)
21	V (NB)	Commutation Output V (60°)
22	W (NZ)	Commutation Output W (120°)
23 - 28	n.c.	-

Pin Configuration QFN28 5x5 mm²



Output Signal Examples



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